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4 Production Diesel-Electrics Types 1-3

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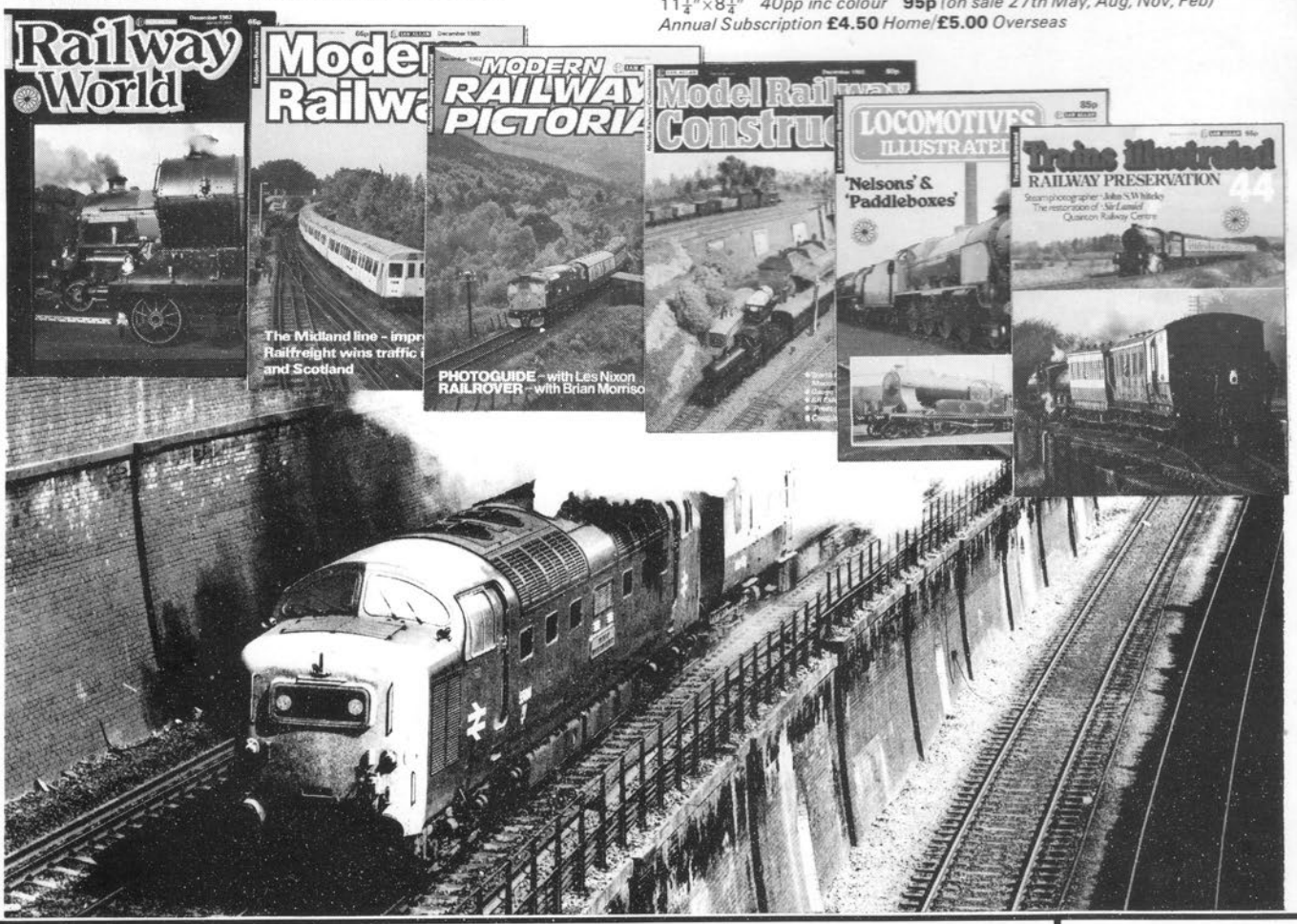

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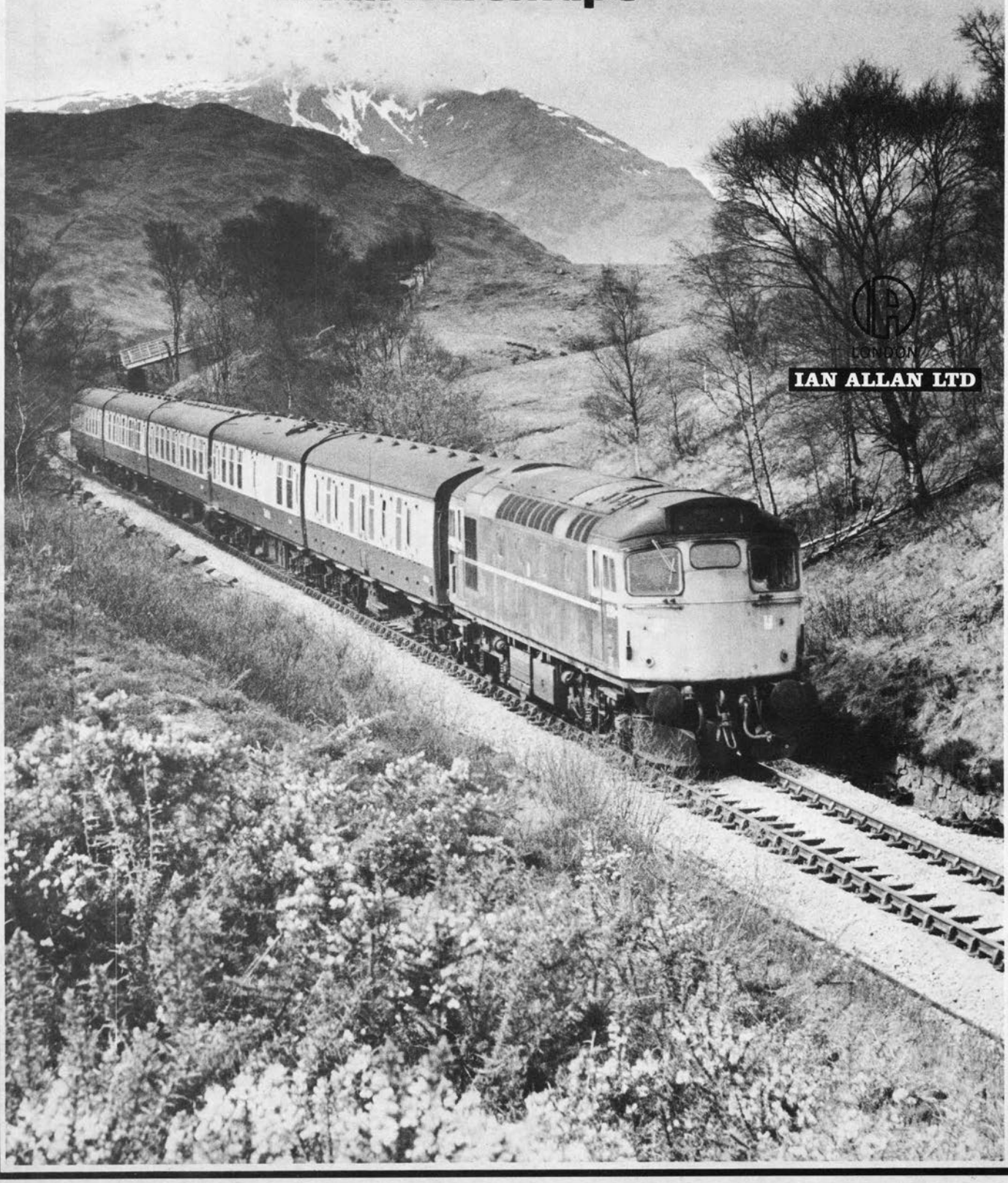

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Cover: Class 37 Nos 37.215 and 37.130 head a Mansfield-Garston coal train on 19 April 1982. *L. A. Nixon*

Title page: Birmingham Railway Carriage & Wagon Co Type 2 Bo-Bo No 5361 heads the 7.25am Mallaig-Glasgow train between Tyndrum Upper and Crianlarich on 28 April 1971. Still in original green livery, the locomotive has the full yellow ends added. Gangway doors in the front end plated over; small snowploughs fitted below the bufferbeam. *J. H. Cooper-Smith*

This page: English Electric Co Type 3 Co-Co No 37.117 speeds an up freight along the East Coast main line between Pilmoor and Raskelf on 1 April 1975. *John E. Oxley*

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The 'Maids of all Work'

A familiar expression in steam days for some of the lesser types of locomotive, and the duties they performed, was that they were 'Maids of all Work'. This could apply to anything from an 0-6-0T for shunting and light passenger and freight or empty passenger stock duties, to the mixed traffic 4-6-0s, such as the GWR 'Hall' class and the LMSR 'Black Fives'. It was a term of affection for their versatility on both passenger and freight work, and it can nowadays be applied equally well to their diesel counterparts, the Types 1 and 2 of the pilot scheme power range; later supplemented by the introduction of the Type 3s. The lack of train-heating equipment on the Type 1 designs was of course a limitation in the winter months, but these engines were to be found working passenger trains in the more clement seasons of the year, and when used in multiple gave a good account of themselves as main line power.

I have already examined, in books 1-3 of this series the background story to the BR Modernisation plan and the events leading to the decision to build diesel and electric locomotives in considerable quantity, and I wish only to remind the reader that what was intended to be a small initial pilot scheme exercise, to try out a number of different designs before settling upon standards for the future, was abandoned whilst incomplete; for political reasons. In the pilot scheme orders (see book one, page 10) there were no less than 10 different designs in the Types 1 and 2 (originally called A and B) power range. Of these, three were for single cab Type A (1) Bo-Bos, without train heating, and seven were for double-ended Type B (2) machines with train heating boilers, and mounted upon a variety of wheel arrangements. The power range was from 800-1,250hp, and a number of different makes of diesel engine and transmission (both electric and hydraulic) equipment were involved; whilst the mechanical parts were constructed in the workshops of both BR and private industry.

There can be no doubt that if the pilot scheme had not been abandoned in the haste that it was, a period of evaluation would have followed and then an acceptable range of standard types would have been introduced; perhaps by repeat orders for the most successful designs or perhaps by new designs based upon the most successful features of the prototypes. In the Type B (2) power range, in particular, there was a considerable divergence of approach shown by various manufacturers and some were very dubious contenders indeed, as described in book one of this series. Fortunately the BTC had quickly realised that there were some 'duds' amongst the new designs and these were soon weeded-out by the simple process of not placing any further orders. However, such was the urgency for diesel power on a big scale that the BTC was forced to place further orders for *all* the more reliable pilot scheme designs in the Type B (2) power range instead of selecting the best one. Thus, four diesel-electric designs (see table) were ordered for quantity production, and two abandoned. In the Type A (1) power range, two designs were perpetuated and one abandoned.

Right: Two EE Co Type 1 Bo-Bos, Nos D8041 and D8035 head the 9.25am Hemel Hempstead-Margate private excursion over Bushey Troughs on 29 May 1960. Lack of train heating facilities meant that the Type 1s could only be used on passenger work in the summer period. *M. Edwards*

Below: The single cab EE Co Type 1 was probably the most successful of the pilot scheme designs, and was ordered for quantity production virtually unchanged in detail. In original green livery, with small yellow warning panel added; no number recorded. The engine is seen climbing Beattock, with steam banking assistance from an LMR Fairburn 2-6-4T. *Derek Cross*

Table A: *Types A (1) and B (2) Pilot Scheme Diesel-Electric Designs Selected for Production*

Type/Class	*Wheels*	*Design/Builder*	*Original Nos*
A (1) 20	Bo-Bo	English Electric	D8000-D8199 D8300-D8327
A (1) 15	Bo-Bo	BTH/Clayton	D8200-D8243
B (2) 21/29*	Bo-Bo	North British	D6100-D6157
B (2) 24/25*	Bo-Bo	BR/Sulzer	D5000-D5299 D7500-D7677
B (2) 26/27*	Bo-Bo	BRCW/Sulzer	D5300-D5415
B (2) 30/31*	A1A-A1A	Brush	D5500-D5699 D5800-D5862

Table B: *Types A (1) and B (2) Pilot Scheme Diesel-Electric Designs not perpetuated*

A (1) 16	Bo-Bo	North British	D8400-D8409
B (2) 23	Bo-Bo	English Electric ‡	D5900-D5909
B (2) 28	Co-Bo	Metropolitan Vickers	D5700-D5719

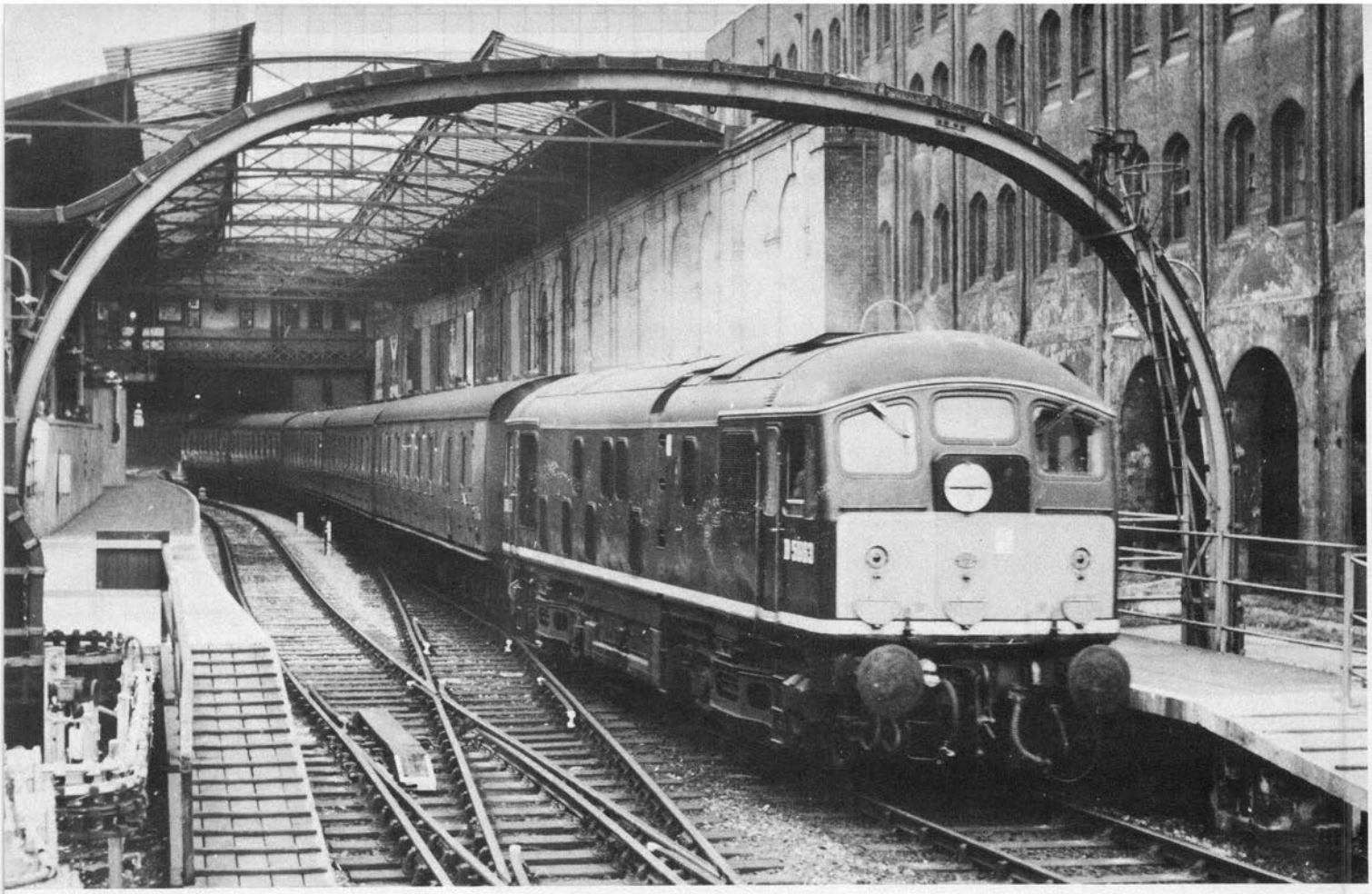
*Denotes later version, or rebuilding ‡'Baby Deltics'

It was hoped to overcome some of the problems that it was foreseen would arise through lack of standardisation by allocating specific types to specific Regions or areas, so that spares and maintenance could be organised more sensibly. It would also ease the task of driver-training which was a problem with the layout of each type being different in certain respects. Nevertheless it meant that everyone involved had to learn to live with six new diesel electric locomotive designs where, given time, only two would have sufficed! To add to the problems, the Western Region was given the go-ahead to build diesel-hydraulics rather than the diesel-electric types to be used on all other Regions, as described in book two of this series.

By selecting four diesel-electric Type 2 designs for quantity production, the BTC found itself dealing with three different diesel engines; the Sulzer, the Mirrlees and the MAN. The Sulzer featured in two designs, the Derby D5000 class and the Birmingham Railway Carriage & Wagon Co D5300 class. In other respects these two designs did not have a lot in common, with different electrical equipment, bogies and body design; despite being evolved from the same basic specification. All three makes of diesel engine were relatively unknown quantities on BR, who had only the brief pilot scheme period to gain experience with them, and sad to relate all three were to prove troublesome in the years ahead, in two cases forcing BR to re-engine the locomotives concerned. It was to be a high price to pay for this headlong plunge into dieselisation!

With the exception of the 1,250hp Brush/Mirrlees D5500 class it could be argued that the power available was low; roughly equivalent to that of the steam locomotives they were intended to displace. Indeed, it was ironical that the single cab Type 1 EE Co D8000 class was virtually as powerful as the larger Type 2s, with their additional cab and extra equipment. It was not long before the BTC and the manufacturers sought to increase the power of the engines installed, and this desirable objective was at first to lead to further problems in terms of engine wear and life. As first introduced, in the pilot scheme, the intention was quite clearly to use them in multiple-unit whenever the power of a single locomotive was insufficient for the duties involved, and it was for this reason that the specification called for gangway connections in the front ends. (A feature which was to affect the appearance of virtually every design, to their detriment.)

The power gap between the Type B (2) designs and the Type C (4) designs was a large one, and ranged from 1,250-2,000hp. No provision was made for locomotives in this power range in the pilot scheme orders.



Above: Derby/Sulzer Type 2 Bo-Bo No D5063 is seen at Farringdon on an evening commuter train bound for the Northern Heights. Original green livery with yellow warning panel added. Photographed on 16 April 1964. *R. Fisher*

Left: During production the Derby/Sulzer design underwent considerable changes to the mechanical portions and the final batches had a redesigned front end and bodysides, as seen here on No 7635, passing Dent station on a down freight; 8 September 1972.
J. H. Cooper-Smith

Right: The BRCW Co version of the Type 2 was to be concentrated on the Scottish Region, once production deliveries were completed. (Some went to the LMR and NER beforehand.) No D5326 displays some small modifications made by the ScR. The air horn grille has a baffle-plate added; the gangway doors in the front end have been removed and plated-over; small snowploughs have been fitted. No D5326 is seen receiving the single line token as it leaves Kyle of Localsh with the 11.10 to Inverness on 13 July 1967. In the lefthand background is BR/Sulzer Type 2 No D5050 on freight duties. *Ian Allan Library*

The manufacturers had pushed the capacity of their larger engines to 2,000hp and beyond, whilst their smaller engines (of a size suitable to be placed inside a Type 2 bodyshell, *plus* electrical equipment and train heating boiler) were still being developed in the 1,000-1,250hp range. Two Type 3 locomotives did already exist on BR, however, and these could have pointed the way for further development. I refer of course to the LMSR 'twins' Nos 10000/1, the 1,600hp Co-Cos, described in book one of the series. Turning the scales at some 130ton in working order, these machines were no 'lightweights', but in their quest for more power the engine manufacturers were

currently allied with BR's engineers in producing even heavier 1Co-Co1 machines! Thus the operating people had no 'general purpose' machine in the 1,500-2,000hp power range; the most useful machine of all. If two Type 2s were worked in multiple it could be argued that they were over-powered at 2,000hp plus for these mixed traffic duties, or if used singly they were perhaps underpowered. The big Type 4s were proving capable machines, but the operators were already crying-out for even greater power for main line duties; thus widening the gap between the Type 2s and Type 4s. The case for the Type 3 was a strong one, and it was not long before Regional engineers and operators put forward their requests to the BTC in favour of Type 3 power. In fact as early as 1957, schemes were being considered at EE Co ultilising the 'Deltic' 18-cylinder engine to produce a 1,700hp Bo-Bo, either in a new double cab unit (see drawing) or inside the existing D8000 style single cab design. But these somewhat remarkable propositions were not accepted, most probably because of some distrust within BR of the 'Deltic' power unit itself, which was still very much an unknown quantity.

Not until 1959 did the first BR-conceived Type 3 take to the rails (excepting Nos 10000/1 already mentioned, and a solitary Brush/Mirrlees locomotive No D5545 which was experimentally up-rated to 1,600 in 1958, as described on page 46). This was No D6500, a 1,550hp Bo-Bo design by the Birmingham Railway Carriage & Wagon Co with a Sulzer engine. This was specifically designed to Southern Region requirements and in some respects it was way ahead of the Type 2s built by the same company in its concept, although outwardly looking extremely similar. The most powerful Bo-Bo locomotive on BR, it was made possible by the Regional decision not to perpetuate steam train-heating. The extra space within the bodyshell made available by removal of the train-heating boiler allowed a larger engine to be fitted, and electrical train heating (eth) was to be used instead.

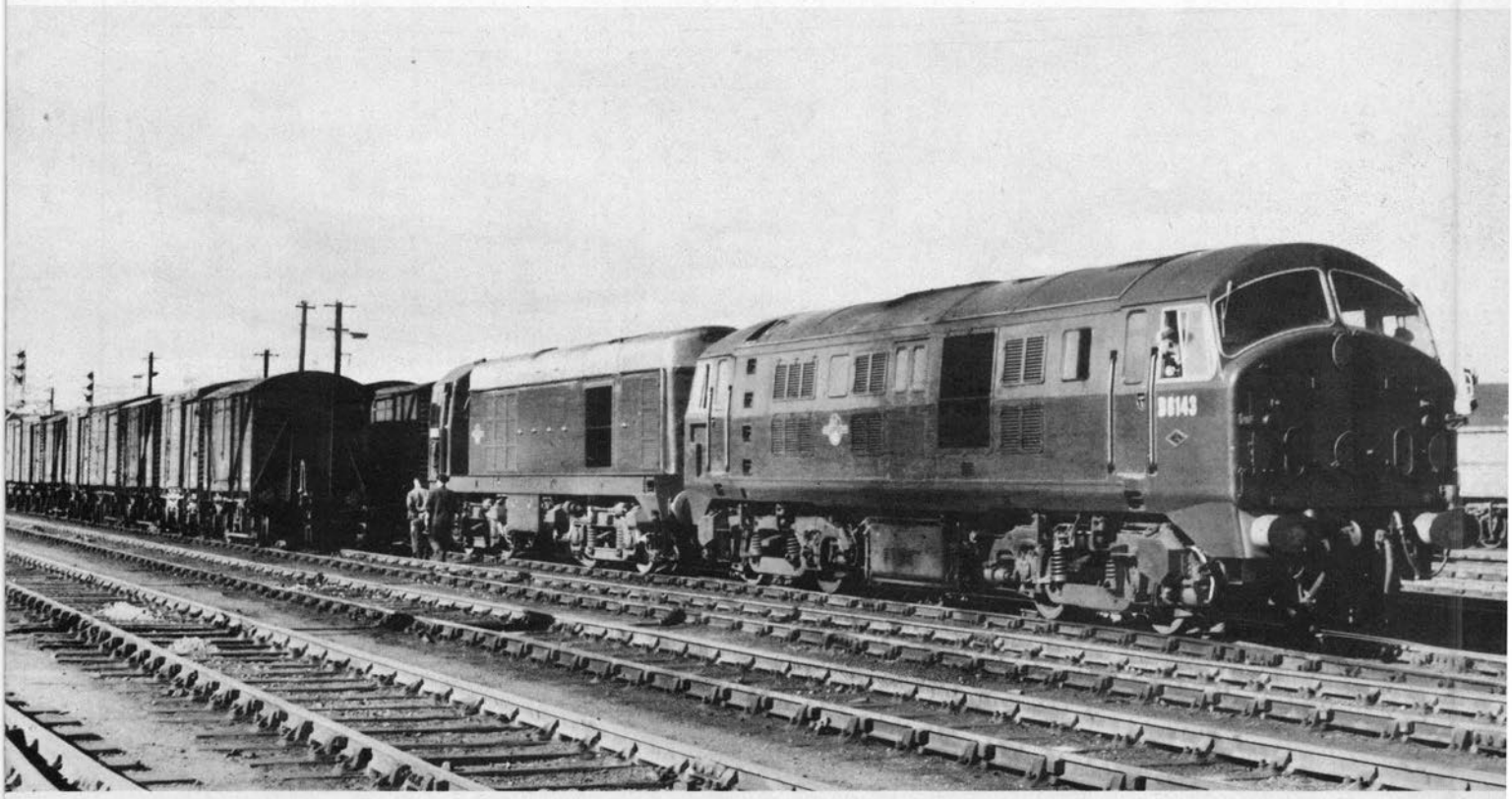
The Southern was fortunate in that the majority of its passenger trains were or soon would be, electrically powered, and only in the summer season were extra trains normally required, with diesel haulage. In winter these diesels spent the majority of their time on freight and similar duties. What few trains still required steam-heating (pending conversion to eth) were temporarily catered for by borrowing some Derby/Sulzer Type 2s which had train-heating boilers; these sometimes worked in multiple with the D6500s.

When one considers the situation today, with eth rapidly becoming standard on BR coaching-stock and when one recalls all the early trials and tribulations that the steam-heating boilers caused; the SR was very progressive in its thinking! In the first five or six years of dieselisation on BR, the failure of the steam-heating boilers during winter months was one which constantly affected locomotive availability. It was galling indeed to see a locomotive standing idle for this reason alone, when its power unit was in perfect working order. Of course, when the boiler failed during a run, the passengers endured a cold journey into the bargain — scarcely good public relations for the new motive power of the Modernisation plan, and of course the problem still exists, in particular on the ScR. Perhaps it was not surprising that in due course, examples of the Type 2 power range that were destined for use in areas mainly involved in freight work were delivered without train heating equipment, once the dieselisation programme had really got under way. It was one less day-to-day headache for the depot staff!

The Modernisation plan had envisaged that all freight trains would be brake-fitted throughout — thereby eliminating the loose-coupled train with brake van attached. This meant that the deadweight of the locomotive was no longer a major factor in safe brake power — as the whole train was braked. Unfortunately this scheme went astray, for several reasons, and the operators found themselves with a collection of new Type 1 and 2 diesels which included some with insufficient brake force to safely work unfitted, or partially fitted, freight trains.

A solution had to be found, because

E
D 5682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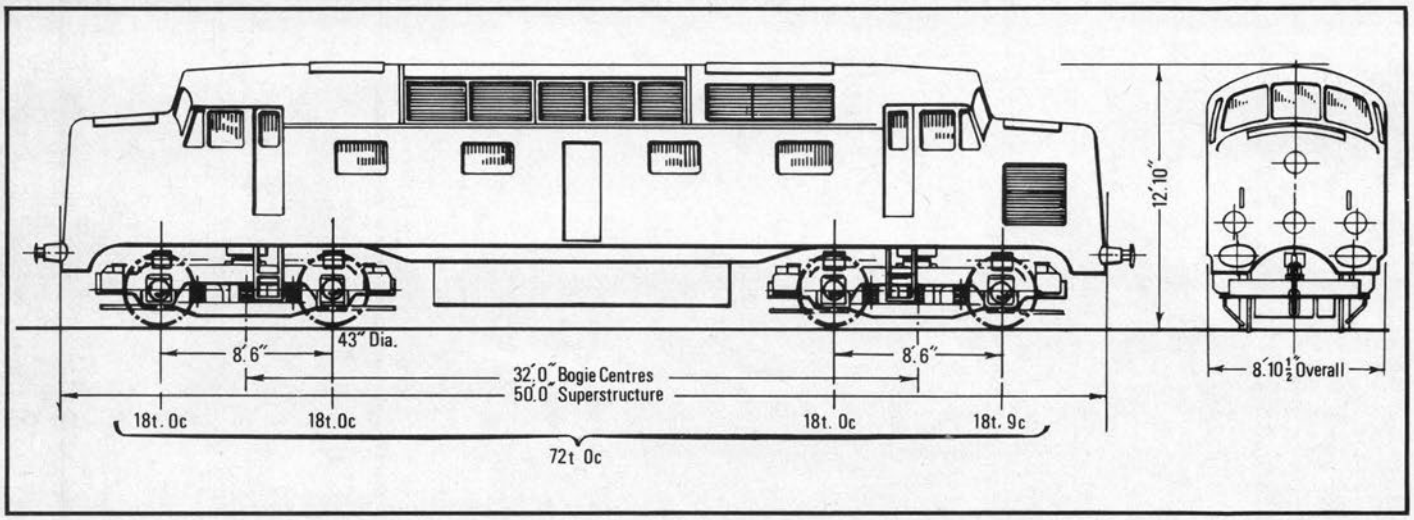


Left: The Brush Type 2 went into quantity production after proving its worth on the ER in the abortive pilot scheme. Only minor changes in appearance were made; the most noticeable being the addition of a four-panel route indicator above the cab windows (which were painted green instead of light blue/grey). The colour of the lining bands was changed to an off-white. No D5682 is seen hauling a train load of containers near Wadsley Bridge, Sheffield on 29 June 1961. *British Rail*

Below left: Without doubt the least successful Type 2 design to be ordered for quantity production was the North British Type 2 with MAN engines. No D6143 of the class is seen working with EE Co Type 1 Bo-Bo No D8031; setting back into Kittybrewster Yard after arriving with a freight from Keith on 16 June 1962. *P. J. Lynch*

Above: Amongst early proposals for a locomotive in the Type 3 power range was this 1957 EE Co design for a 72ton Bo-Bo, using a 'Deltic' 18-cylinder engine. It was an alternative to the Type 3 Co-Co which is todays Class 37.

Centre right: The Southern Region introduced the BRCW/Sulzer Type Bo-Bo, with 1,550hp, as part of their plan to eliminate steam traction from the Region. No steam-heating was provided, thereby allowing room for a larger engine to be installed within the Type 2 bodywork. No gangway to front ends and standard SR two-panel route indicator in the centre cab window. (Nevertheless this engine carries headcode discs!) No D6505 is seen in original livery, passing Chelsfield on the 4.30pm Victoria-Folkestone Harbour Boat Train, on 29 May 1960. *Derek Cross*

Right: The decision to abandon the development of diesel-hydraulic traction on the Western Region resulted in large orders being placed for the versatile EE Co Type 3 Co-Co design. A brand new example, No D6829 is seen at Gloucester on a running-in turn; the 3.00pm Gloucester-Swindon stopping train, on 4 April 1963. Green livery, with grey roof and small yellow warning panels. The steam-heating boiler appears to be over-effective! *W. L. Underhay*

8T

7P20

The Diesel Brake Tenders

Left: To provide adequate brake power on unfitted or partially fitted freight trains, BR produced the Diesel Brake Tenders, utilising old carriage bogies to carry a deadweight load encased in steel. Some tenders were painted locomotive green (later blue), some were originally a more Khaki shade. Yellow warning panels were added to each end, as seen here; with the brake tender leading ahead of EE Co Type 3 Co-Co No D6781. The train is an eastbound ore working, seen near Leyburn; passing some old limekilns on 3 September 1963. Oil lamp headcode carried. *P. H. Wells*

Below left: The Brake Tenders were low enough in profile not to impair the driver's forward vision too much. Here a BR/Sulzer Type 2 Bo-Bo No D5178 propels a tender whilst working an empty wagon train from Tyne Yard to Consett. Photographed approaching Pelaw South Junction on 24 October 1964. *Brian Stephenson*

Right: Two EE Co Type 3s (the nearest is No D6758) stand on shed, with a Brake Tender sandwiched between them (one of the khaki green examples). *Ian Allan Library*

Below: With the Brake Tender marshalled behind the locomotive, EE Co Type 3 Co-Co No D6761 is seen shunting its train of 'empties' into Cargo Fleet Inner Yard, on 13 March 1965. *Ian G. Holt*

OT44
D150

D6123

Above left: It was a desire to improve the driver's vision when working in either direction that led to the centre-cab layout of the BR 'standard' Type 1 Bo-Bo design; the Clayton Equipment Class D8500. The second locomotive built, No D8501, is seen at Belper, whilst on a trial run from Derby to Millersdale and back, on 23 August 1962. The locomotive is still in undercoat. *M. Norman*

Above: The driver's cab of the Clayton Type 1 certainly gave an excellent all-round view for the driver, and was well detailed. The upper part and fronts were in pale grey/green; recess for tablet catcher on the side between worksplate and BR emblem. *British Rail*

Left: As stated already, the North British/MAN Bo-Bos were the least satisfactory of the production series Type 2s, and it was decided to experiment by re-engineing one example, No D6123, with a 1,350hp Paxman engine. The 'guinea-pig' is seen here on a test train at Fullwood Junction, Mossend on 10 July 1963. The upper portion of the bodyside was painted in light grey/green. A total of 20 were eventually re-engined with Paxmans. *W. S. Sellar*

otherwise the new motive power would be under-utilised. The answer that BR came up with was a crude but effective affair called the 'Diesel Brake Tender' — a dead-weight load encased in steel sheeting and mounted upon secondhand Gresley (LNER) or other old carriage bogies. This unsightly object could be propelled in front of the locomotive (being sufficiently low in overall height so as not to impair the forward vision of the driver), or it could be taken in tow. It soon became completely grime-encrusted, because obviously no one was going to waste time upon cleaning such an item, and when yellow warning panels were painted upon the ends in an attempt to make their approach more visible, these panels were soon obliterated. To sum up, it was ugly but efficient — except in terms of economics!

The second Type 3 diesel-electric design to be introduced was perhaps more othodox in concept than the SR version, in that it carried a steam-heating boiler. The EE Co Class D6700 design was a Co-Co (thus echoing the LMSR Nos 10000/1) of 1,750hp and the bogies used were developed from those designed for the prototype 'Deltic' locomotive. The D6700 class may perhaps be described as the finest of all the BR diesel fleet in service today, being both versatile and extremely reliable.

The early 1960s was the worst period for BR dieselisation, when it found itself the not-so-proud owner of a varied collection of Type 1 and 2 designs that had revealed their true virtues and failings by that time. In the Type 1 power range the EE Co version, the D8000 class, had revealed itself to be a strong and reliable locomotive, but there were problems with driver visibility with the single cab at one end only. Due to this the BTC had agreed to a new standard version of the Type 1, a second generation design in which the cab was to be placed in the centre of the locomotive giving good all-round visibility. To achieve this, two smaller engines were required per locomotive, and these were housed in low bonnets. An attractive looking machine resulted, but in terms of performance it was ill-starred and although 117 were built, there was a subsequent decision to revert to construction of the EE Co version, as being altogether more reliable!

In the Type 2 fleet the North British/MAN Bo-Bos gave considerable trouble and it was eventually decided to re-engine some of them. The Brush/Mirrlees design also revealed engine problems that were so severe that the entire class was re-engined. After various teething troubles the Sulzers had settled-down to give a good performance. The mechanical parts were also showing their faults. In particular the Scottish and North of England engine crews complained of draughty cabs, partly because of the gangway doors in the front ends, and partly because of bad workmanship in the fitting of doors and windows. The train-heating boilers continued to give troubles and affect availability. Electrical equipment had its fair share of troubles, ranging from traction motor flashovers to main generator problems. A great many people worked extremely hard behind the scenes at this time to keep the fleet of mixed traffic locos in service with acceptable availability.

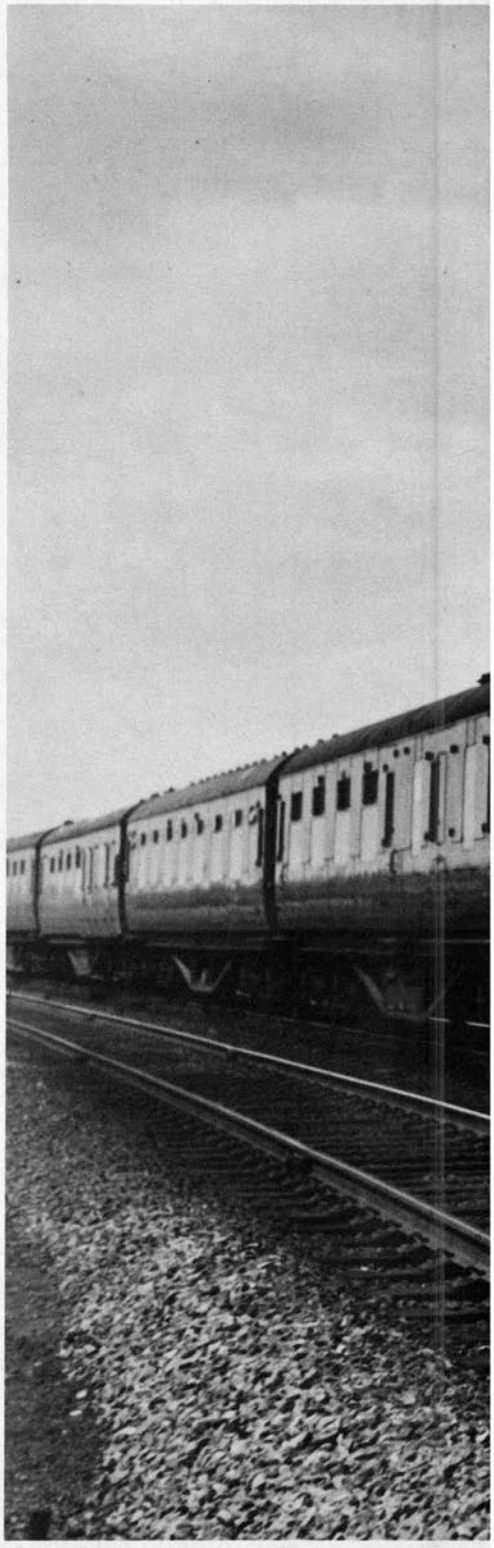
The National Traction Plan arose from this phase, as a determined effort by the British Railways Board to rationalise the number of locomotive types in service, by eliminating the less efficient classes and concentrating maintenance and overhaul programmes upon those considered worthy of the expense. From this 1965 Plan arose the present-day fleet, with much improved reliability and performance. Indeed, no new Type 1 or 2 locomotives have appeared on BR rails for many years, and its seems that by refurbishing and programmed overhaul just under half of the present fleet will still be

in service for another 10 years or more. The same applies to the Type 3s, although these have not suffered anything like the trials and tribulations of their smaller brethren, and both classes are expected to remain virtually unscathed numerically over the next decade.

A gradual run-down in numbers can be expected amongst the Type 1s, because new freight locomotives of Classes 56 and 58 will reduce the present practice of double-heading (with the cabs at the outer-ends) which is the semi-permanent arrangement for the class in many areas. The remaining Derby/Sulzer Bo-Bos, today's Class 25 will probably disappear by 1985/6 and the more efficient Class 26 will be steadily thinned-down in numbers over the decade; also the Brush Class 31s. The Class 27s will probably be halved in number by 1991. If electrification schemes get the go-ahead, the demand for diesel power will be substantially reduced, and one is left wondering whether a new standard Type 2 will ever appear. What would seem more probable is a requirement for a new generation of electro-diesel locomotives. (This type of locomotive will, incidentally, be described in book six of this series.)

In terms of appearance the Types 1-3 designs were a very mixed bunch indeed. I have already described in book one of this series the efforts made by the BTC Design Panel to clean-up the exteriors and obtain a degree of family likeness for the fleet. When the two Type 3 designs appeared they simply followed existing manufacturer's practice, unlike the Western Region's hydraulic version, the 'Hymek', which was restyled completely. The addition of four panel route indicators caused problems on locomotives with gangway doors fitted, and unfortunately some clumsy solutions were arrived at. Livery changes have improved the look of some designs and reduced that of others! Apart from the Clayton Type 1 (and the 'Hymek') the Design Panel has never had an opportunity to give further thought to the apearance of locomotives in these power ranges. Nevertheless the classic appearance of the EE Co Type 1, and to a lesser extent the Brush and BRCW versions of the Type 2/3, continue today as a living tribute to the Panel's pioneer efforts in the field of aesthetic locomotive design. It is an odd fact that some of the less satisfactory locomotives in terms of appearance also turned out to be the least satisfactory in performance, and have since been scrapped. Perhaps the term 'Handsome is as handsome does' really does apply to diesel locomotives!

A word about liveries is necessary because in recent times some semi-official and distinctly unofficial variations have appeared; in particular on selected examples of Classes 31, 33 and 37. Some of these have resulted from enthusiasm at local depots, perhaps to decorate locomotives destined for railtours or even Royal train workings. Typical of these admirable endeavours are the embellishments made by Stratford depot, with silver/grey roofs and red bufferbeams added. The SR has recently decorated a few



Left: Time was to take its toll on the Mirrlees engines used in the Brush Type 2 A1A-A1A design (partly because of higher power ratings applied) and the entire class was re-engined with EE Co power. No D5699 makes a pleasing picture as it hurries under a bridge near Raydon Wood on the Bentley-Hadleigh branch, with the 12.30 Ipswich-Hadleigh freight on 13 April 1965. Yellow warning panel painted on front end. *G. R. Mortimer*

Above: Later examples of the Sulzer-engined Types 2s (both the BR and BRCW Co designs) had the horsepower increased to 1,250. Fresh from the Birmingham factory, No D5389 is seen on a crew-training special on the Midland main line, whilst allocated to Cricklewood shed. *British Rail*

Class 33 locomotives for naming ceremonies in similar style. More dramatic has been the appearance of a few locomotives with complete yellow cabs with black window surrounds. These evidently seek to imitate the new official livery as carried by Classes 56, 50 an 47 but without the large symbol and numerals which are an important feature. It would appear that financial constraints are hampering any official change to the new style livery for the smaller types of locomotive (the Types 1-3 power range), but the Author has seen drawings prepared by the BRB Department of Industrial Design to show how these new schemes should be applied, and it is to be presumed that they will be painted in these new liveries in due course.

Finally, on the subject of locomotive technical detail differences, I would advise the reader to study the current edition of the Ian Allan ABC*, because the situation with regard to the fitting of train-heating boilers; electrical train heating; boiler isolation; air brakes for train working, etc, is a very fluid one. Changes are made to suit operating requirements, perhaps allied to a reallocation to another Region, and it would be impossible to list all these variations in this book. What I have selected for the reader is a typical set of data for the final production versions of each main class, or type, as built, or as subsequently rebuilt, and it must be emphasised that within some classes of locomotive in these power ranges substantial changes are still being made.

Once again, in this series, I must gratefully acknowledge the kind assistance given by the Ian Allan Library, and many individuals, in providing illustrations, and background information. It would be invidious to single out names — to all, my sincere thanks.

Brian Haresnape FRSA NDD
July 1982

*Ian Allan *ABC British Rail Locomotives* (includes all diesel and electric locomotives) published annually.

All Duties - Great and Small

From Royal trains to ballast trains; from summer excursions to pick-up freights; from exhibition specials to weed-killing duties. The BR 'Maids of all Work' are saluted here in this brief pictorial representation of some of many duties that they have been called-upon to handle; yesterday and today.

Left: Main line passenger work for BRCW Type 2 No 5391, seen leaving Mound Tunnel, Edinburgh on the 12.30 push and pull to Glasgow on 9 June 1972. Full yellow warning ends and gangway door plated over. Electric train heating fitted. *J. H. Cooper-Smith*

Above right: The Royal Train conveying HM The Queen from Kings Lynn to Liverpool Street approaching Spellbrook, south of Bishop's Stortford on 14 January 1967, hauled by two Brush Type 2 A1A-A1As, No D5553 and D5632, in truly immaculate green livery. The leading engine No D5553 has two experimental headlights fitted above the buffers. *P. Paye*

Right: The empty stock of a Wolverton-Scunthorpe Royal Train working is seen headed by a pair of LM Region Type 2 BR/Sulzer Nos 25.068 and 25.069 approaching Doncaster on 6 May 1974. Later the same day the two locomotives hauled their Majesties the Queen and Prince Philip from Scunthorpe to Preston, after a ceremony at the new Anchor steelworks at Scunthorpe. The leading cab has radio communication with the train. *C. P. Boocock*

Below: When the BBC TV programme 'Nationwide' took to the rails for a week, in July 1977, a Brush Type 2, No 31.409 was specially groomed to head the train; seen here at Whitehall Sidings, Leeds on 14 July. *G. W. Morrison*

Above left: A moment of pride and great sorrow. Two SR Type 3 Bo-Bos, Nos 33.027 and 33.056 head Lord Mountbatten's funeral train, the 12.55 special from Waterloo to Romsey on 5 September 1979; seen passing Vauxhall. *J. Scrace*

Left: A cross-London transfer freight, from the Great Eastern line to Norwood Junction, via the West London Extension Railway passes Clapham Junction on 14 July 1962, in the charge of BTH Type 1 Bo-Bo No D8229. *Brian Stephenson*

Above: A pair of EE Co Type 1s (today's Class 20) make a very typical picture hauling a short train of coal wagons past the new Woodville Disposal Point sidings, working wrong line to Overseal sidings (Staffs) on 16 June 1980. Nos 20.187 and 20.171 show the now characteristic coupling-up with cabs at outer ends to give good driver visibility. Four panel route indicator modified to show two marker lights. *C. J. Tuffs*

Right: Deputising for a Class 47 two Type 2s head a 'merry-go-round' coal train on the Midland main line; leaving Glaston Tunnel on 22 April 1975. The leading locomotive is Brush Type 2 No 31.452 and behind (working in multiple) is BR/Sulzer Type 2 No 25.256; both in standard BR blue livery with yellow ends. *J. H. Cooper-Smith*

5B78

Left: Electrification has now ousted all the ER Type 2s from Great Northern line suburban workings. A memory of the past is presented by this picture of Brush Type 2 (today's Class 31/1) A1A-A1A No 31.198 emerging from the 'Drain' at Kings Cross, with empty stock from Moorgate on 12 June 1975. The huge trainshed of St Pancras is in the background, and the Post Office Tower in the distance. *Brian Morrison*

Below left: A humdrum but necessary duty is the yearly weed-killing train; helping to keep BR's permanent way in presentable order. Without it the proliferation of summer weeds would soon make the tracks look like some disused branch line! Here we see BRCW Type 2 No 26.032 passing Aviemore on 1 June 1978 on such a duty. The locomotive carries twin headlights on the front end, plus small snowploughs — both reminders of the tough conditions these Highlands-based locomotives are expected to operate in. The two coaches are of Southern Railway origin — now far from home! *John Chalcraft*

Above: March snows make Betchworth station a bleak looking spot on 16 March 1964 as SR Type 3 Bo-Bo No D6591 heads an up freight on the Guildford-Redhill line. This is one of the narrow-bodied version produced by BRCW to suit the Hastings line loading-gauge (today's Class 33/2) and this example is fitted with miniature snowploughs. *G. D. King*

Above right: In the difficult final phase of electrification on the Waterloo-Bournemouth line, steam and diesel power were intermingled in efforts to keep services running smoothly, despite delays and diversions created by engineering works. Here a smart-looking BRCW Type 3 Bo-Bo No D6556 double heads rebuilt Bulleid 'West Country' class Pacific No 34017 *Ilfracombe* on the down Pullman car 'Bournemouth Belle', seen leaving Alton on 24 April 1966. The light-coloured portions of the diesel's roof are manufactured in translucent fibreglass. *M. Pope*

Right: The conversion of some of the SR Type 3s to 'push and pull' working has given the locomotives even greater versatility. Pictured at Weymouth is No D6527 (in BR blue livery with yellow ends), propelling a train to Bournemouth on 10 June 1967. Steam locomotives still occupy the depot in the background. *R. E. Toop*

Above: EE Co Type 3 Co-Co No 37.253 shunts a train of ballast wagons at Newbury on 8 November 1974. *D. E. Canning*

Left: Hauling a substantial load of new motor cars two BR/Sulzer Type 2 Bo-Bos are seen near Thornhill on 5 June 1972. The leading locomotive, No 5207 is in the standard blue livery but the second, No 5287 is still in two-tone BR green. *J. H. Cooper-Smith*

Above right: Amidst the rugged Cornish mining landscape at Scorrier, between Redruth and Truro, BR/Sulzer Type 2 (now Class 25/2) No 25.227 heads an up freight on 9 July 1976. *Brian Morrison*

Right: This small pictorial tribute ends as it began, with an Edinburgh-Glasgow 'push and pull' Inter-City working; photographed in Princes St Gardens Edinburgh. BRCW Co Type 2 No 27.208 leading and sister locomotive 27.108 at the rear. Nowadays these trains are the exclusive roster of the Class 47/7 Co-Cos, with converted Mk 3 carriages. *G. A. Watt*

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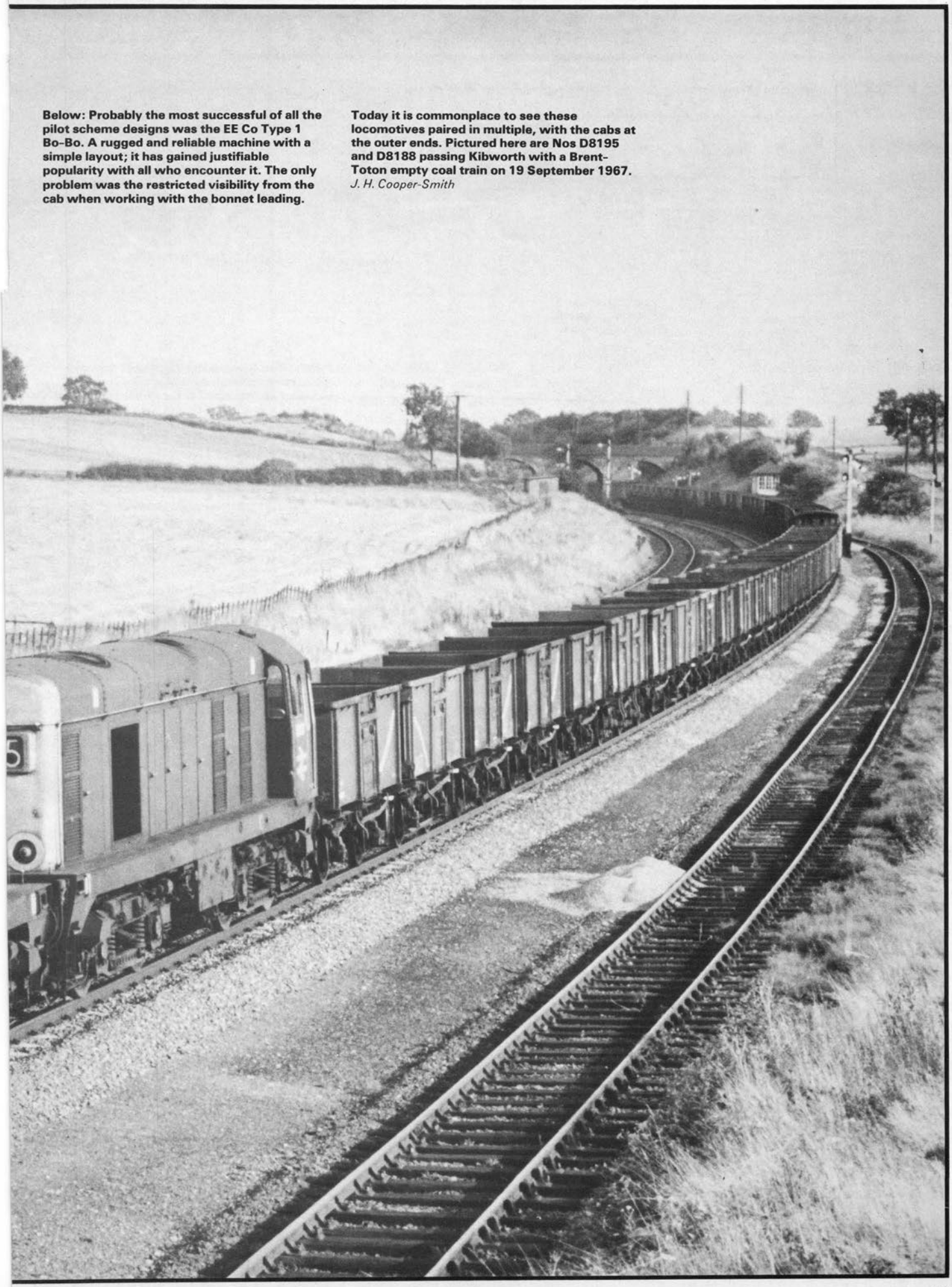
Pilot Scheme Designs Perpetuated

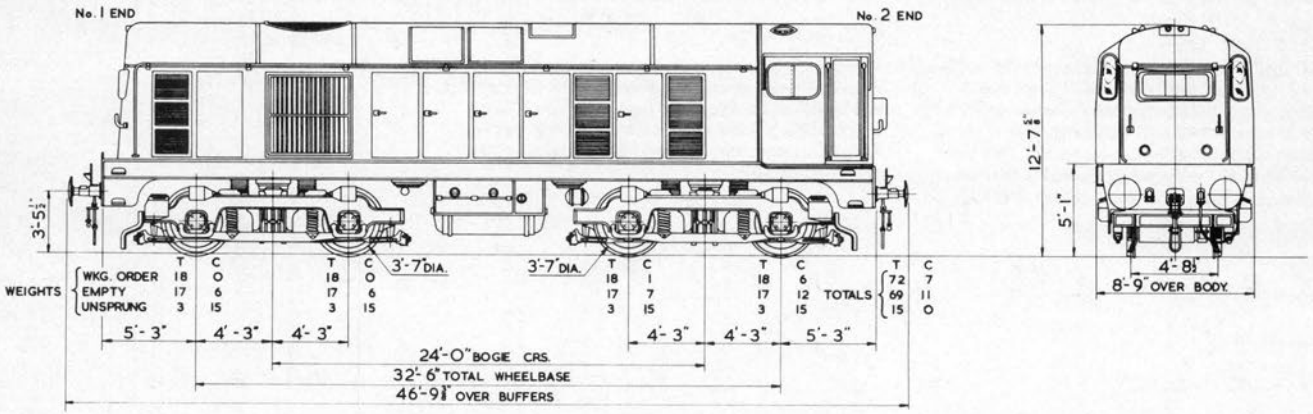
Two Type 1 and four Type 2 diesel-electric pilot scheme designs were selected for further production orders despite the very limited experience BR had gained from the prototypes. Today's fleet still relies upon many of these locomotives; in some cases in much modified form. Some have long since gone, but many however, have fully lived up to expectations, and we can expect to see them in service for a good many years to come.

Below: Probably the most successful of all the pilot scheme designs was the EE Co Type 1 Bo-Bo. A rugged and reliable machine with a simple layout; it has gained justifiable popularity with all who encounter it. The only problem was the restricted visibility from the cab when working with the bonnet leading.

Today it is commonplace to see these locomotives paired in multiple, with the cabs at the outer ends. Pictured here are Nos D8195 and D8188 passing Kibworth with a Brent-Toton empty coal train on 19 September 1967.
J. H. Cooper-Smith



1 English Electric Co 1,000hp Bo-Bo Type 1



Class: BR Type 1, later Class 20
Purpose: Freight locomotives
Introduced: 1957
Original numbers: D8000-D8019 (pilot scheme) D8020-D8199, D8300-D8327
Total built: 228 (including 20 pilot scheme)

Details of Nos D8020-D8199, D8300-D8327

Engine: English Electric 8SVT Mk II
No of cylinders and cycle — 8, four stroke
Max cont rated output — 1,000hp at 850rpm
Main generator: English Electric EE819/36
Traction motors: Four English Electric Type EE526/5D.
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 42,000lb at 26% adhesion at 1,800A main generator
Cont tractive effort — 19,500lb at 14.8mph at 1,000A main generator
Rail hp at cont rating — 770hp
Full engine output — available between 5 and 75mph
Braking: Air for loco, vacuum for train giving a brake force of 82.8% of loco weight in working order (see also text)
Speed: 75mph (max permitted service)
Curve: 3½ chains min rad curve without gauge widening, at dead slow speed
Train heating equipment: Not fitted
Tank capacities: Engine fuel — 400gal (some 380gal)

Today, only one locomotive class in the Type 1 category still serves BR, out of a total of four classes that have been constructed since the changeover from steam traction began. Ironically this surviving class had the distinction of being the very first to be delivered to BR in the pilot scheme orders, with No D8000 going into service in June 1957, and with all 20 running by March 1958; as described in book one of this series.

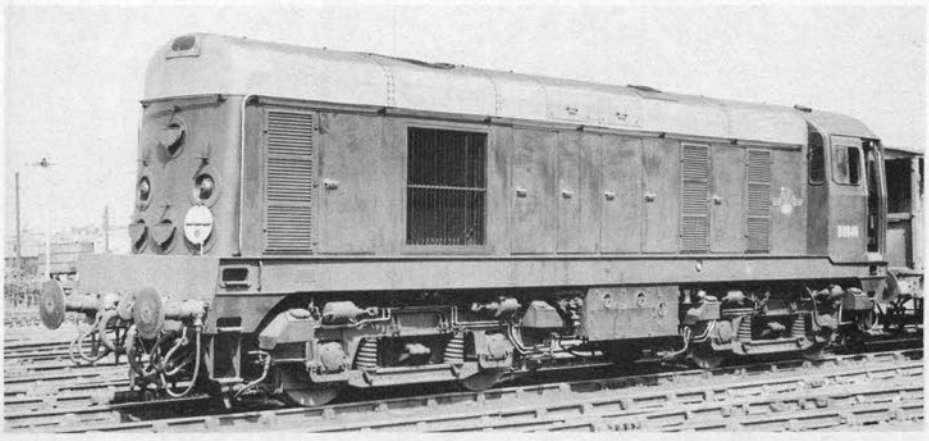
The production orders commenced with No D8020 which was delivered to BR in October 1959 and continued steadily, to reach No D8127 in July 1962, by which time they were in use on the LMR, ER, NER, and ScR and had established an enviable reputation for reliability. BR, however had meanwhile decided that the visibility problem of single cab hood units could be overcome by adopting the new Clayton Type 1 design with Paxman engines (see Section 9) which was ordered in quantity without construction of a prototype, and which then was regarded as the standard design for the Type 1 power range. The failure of this design to come up to expectations was so rapidly revealed that a further order for 100 of the EE Co version was placed, with deliveries commencing with No D8128 in June 1966 and ending with D8327 in February 1968. The class eventually totalled 228 locomotives, of which over 200 are still in service today and are now regarded as *the* standard design.

Above: The drawing depicts one of the later production batches, with four panel route indicator incorporated in the bonnet nose, and added as a box to the rear of the cab.

Construction of the class was shared between Vulcan Foundry: Nos D8000-D8019, D8035-D8049, D8128-D8199, D8300-D8327; and Robert Stephenson & Hawthorn: Nos D8020-D8034 and D8050-D8127. Details were only slightly changed during production, to suit BR requirements, in particular the fitting of four-panel route indicators on Nos D8128 onwards, but the basic design remained unchanged throughout. Today there are variations in braking equipment, and weight differences as a result; some examples being dual-braked. Although not fitted with train heating equipment, the class featured a continuous train steam heating pipe running from bufferbeam to bufferbeam so that they could work in multiple with boiler-fitted locomotives, even if coupled next to the leading carriage.

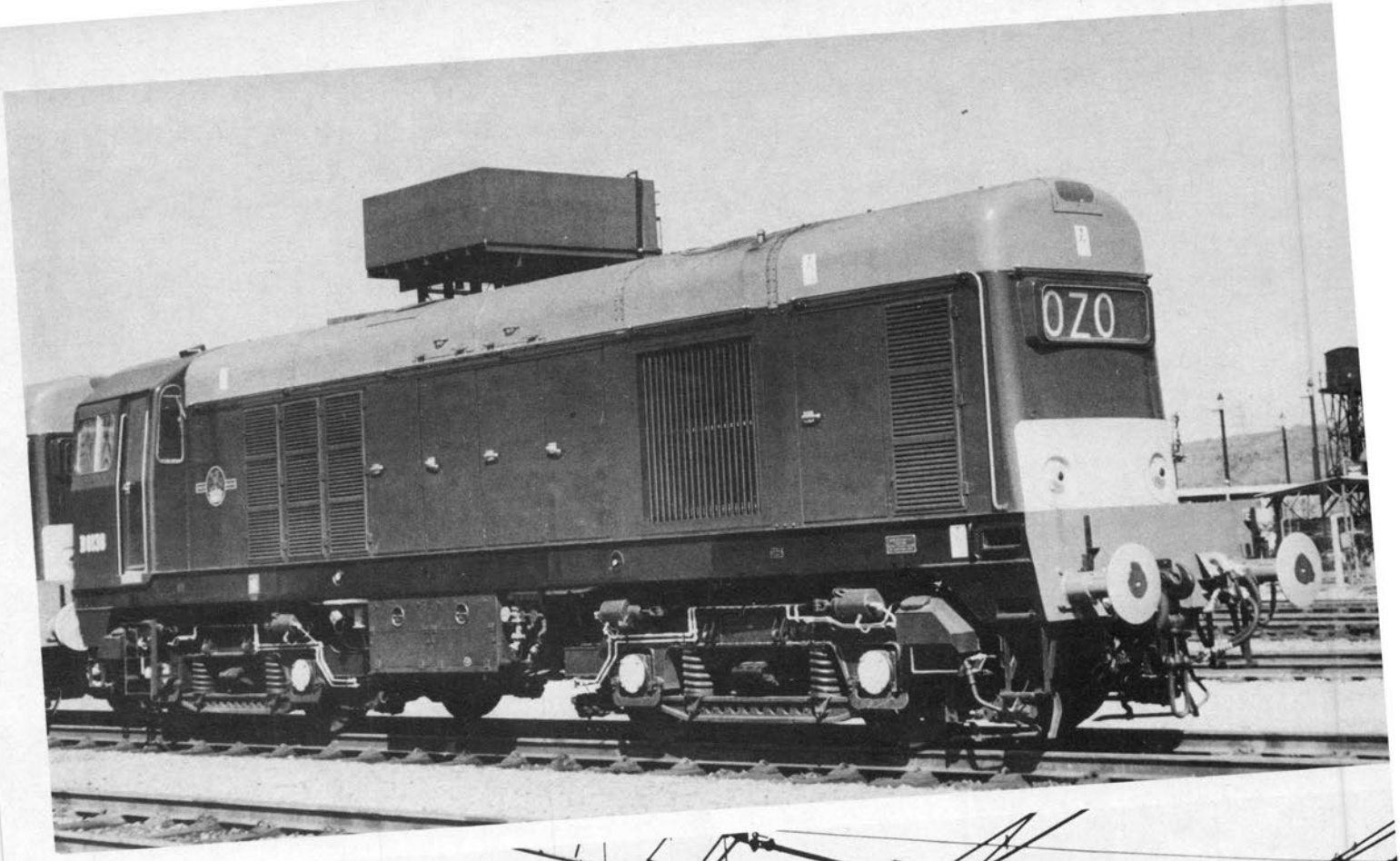
The Class 20s, as they are now known, are frequently worked in pairs with the cabs at the outer ends; forming a 2,000hp twin-unit freight locomotive. This configuration, with full width cabs and narrower engine bonnet between, is echoed in the design of the new Class 58 freight locomotive (see book three of this series) and it is this new generation of freight locomotives that will eventually oust the class from BR freight duties. Meanwhile No 20.050 (the prototype locomotive No D8000) is to be officially preserved by the National Railway Museum.

Below: The production orders entailed virtually no change in appearance to begin with, and the livery remained the same. Dark green bonnet and cab; grey bonnet top: black bogies and running gear and red bufferbeams. No D8040 is seen here at the LMR's Devons Road diesel depot on 12 June 1960. *P. H. Groom*



Top right: The four panel route indicator was added to the later locomotives commencing with No D8128, during construction and a neat arrangement was produced for the bonnet nose. The small yellow warning panel was another addition, which together with the deep red bufferbeam gave quite a colourful effect! No D8138 in brand new condition is seen at Toton on 30 April 1966. The orders for Nos D8128-99/8300-27 were placed by BR after the standard Clayton Type 1 design had failed to prove its worth. *Ian G. Holt*

Right: With the cab end leading, EE Co Type 1 Bo-Bo No D8053 heads a lengthy transfer freight on the approach to Sheffield (Victoria) station on 22 July 1963. *Brian Stephenson*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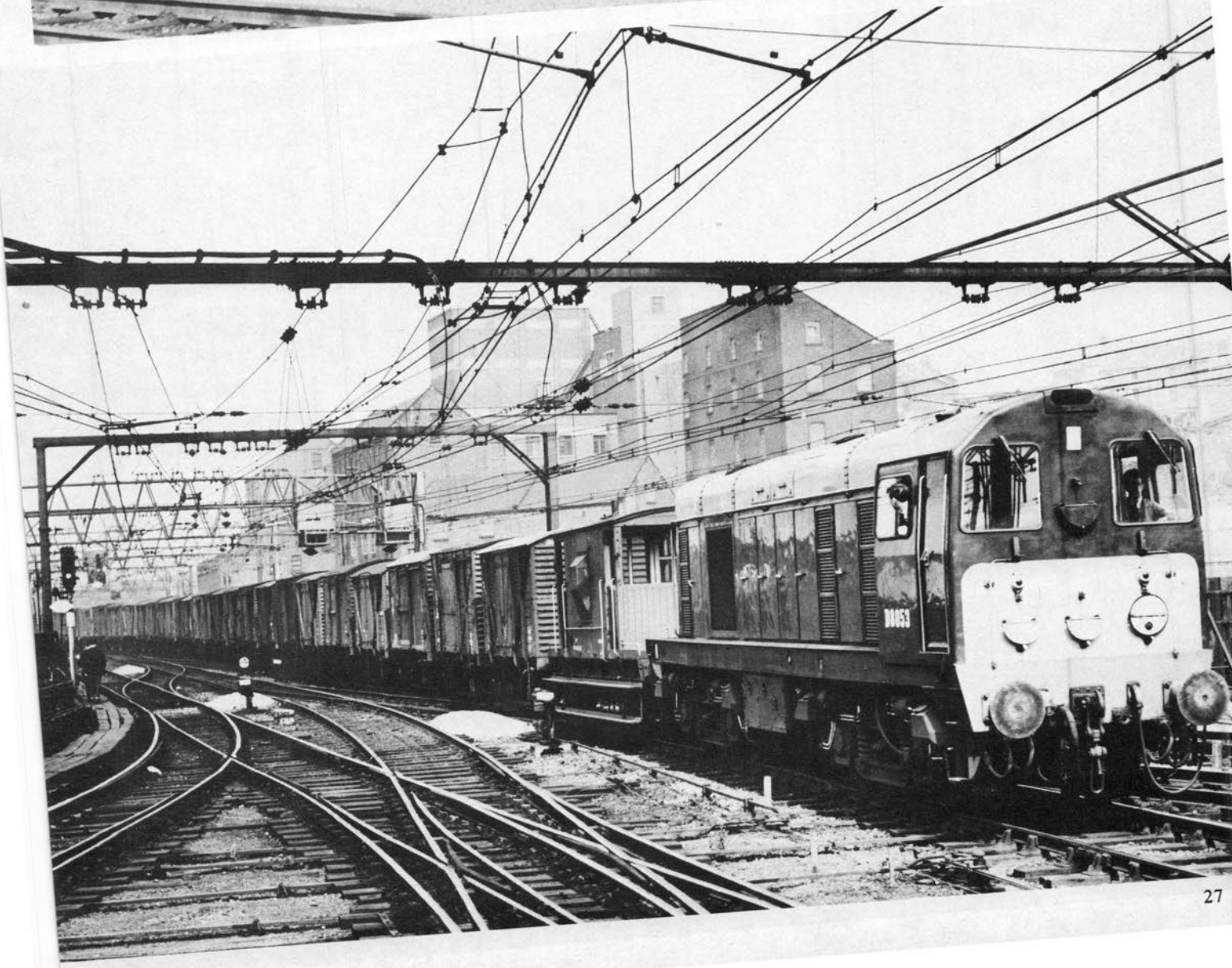
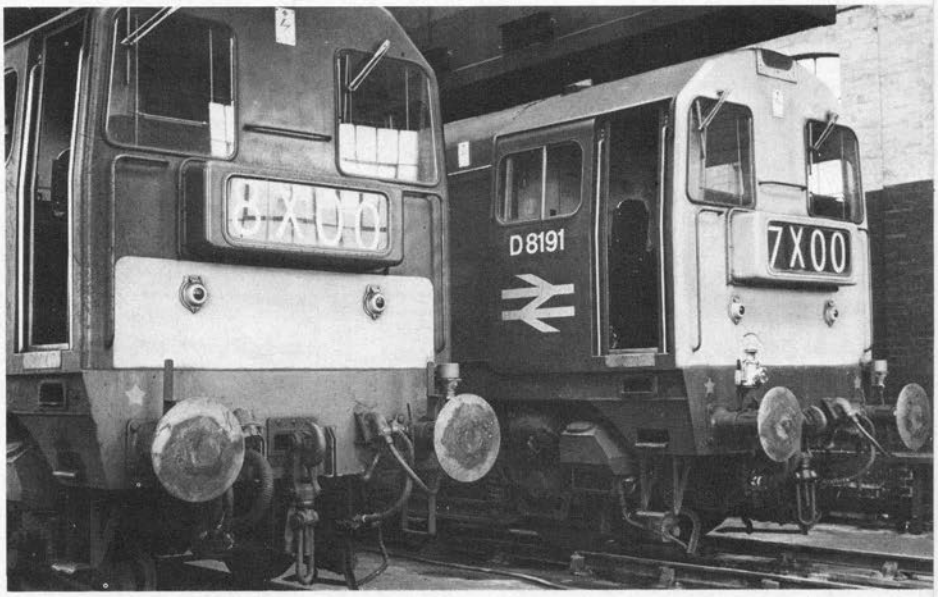


D8049



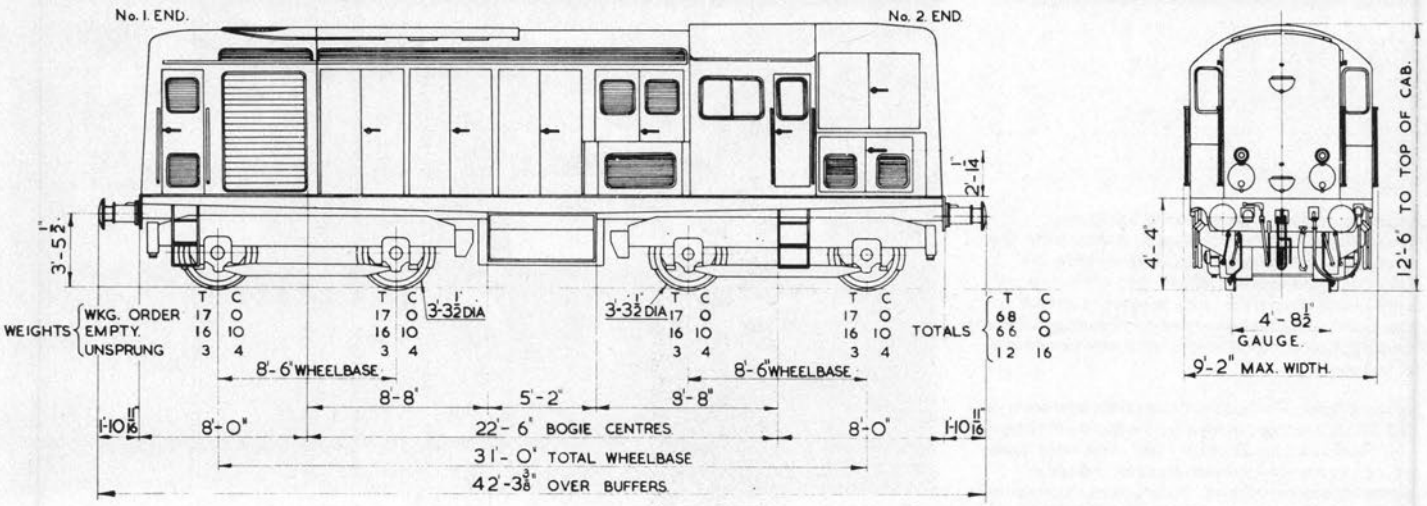
Left: No D8049 was selected for livery experiments by the BR Design Panel, with the body painted in corporate identity blue (including the bufferbeams) and with overall yellow warning ends, and the new symbol on the cabsides. The wrong style of numerals were carried, being those in use on the green locos. *British Rail*

Above right: The correct numerals are seen on No D8191 in this picture taken inside Kirkby-in-Ashfield shed on 28 May 1967. The later type of cab end with four panel route indicator added is well depicted. Note the rearrangement of the handrails compared to No D8049 (previous picture). The nearest locomotive is No D8163, still in green livery, with small yellow warning panel. Blue star coupling code painted on the bufferbeams. *D. L. Percival*

Right: No D8048 was another early candidate for blue livery, and someone must have had a red face in the paintshop because the BR two-way arrow symbol has been painted-on *back-to-front*! Photographed at Immingham on 28 May 1967. Like No D8049 the engine has blue bufferbeams. *D. L. Percival*

Below: The correct present-day livery of the Class 20s as they are now known, is seen here, with black bufferbeams below the yellow ends. No 20.170 also shows the two marker lights that have replaced the four digit route indicator. Class 20s No 20.170 and 20.158 are seen restarting the 15.07 Plymouth-Manchester out of Cheltenham Spa on 28 May 1980. BR symbol relocated on bonnet sides, near the cab. *C. J. Tuffs*

2 British Thomson-Houston 800hp Bo-Bo Type 1



Above: The drawing depicts the production version of the Type 1 BTH Bo-Bo with Paxman engine; built by the Clayton Equipment Co.

Class: BR Type 1, later Class 15
Purpose: Freight locomotives
Introduced: 1957
Original numbers: D8200-D8209 (pilot scheme) D8210-D8243
Total built: 44 (including 10 pilot scheme)

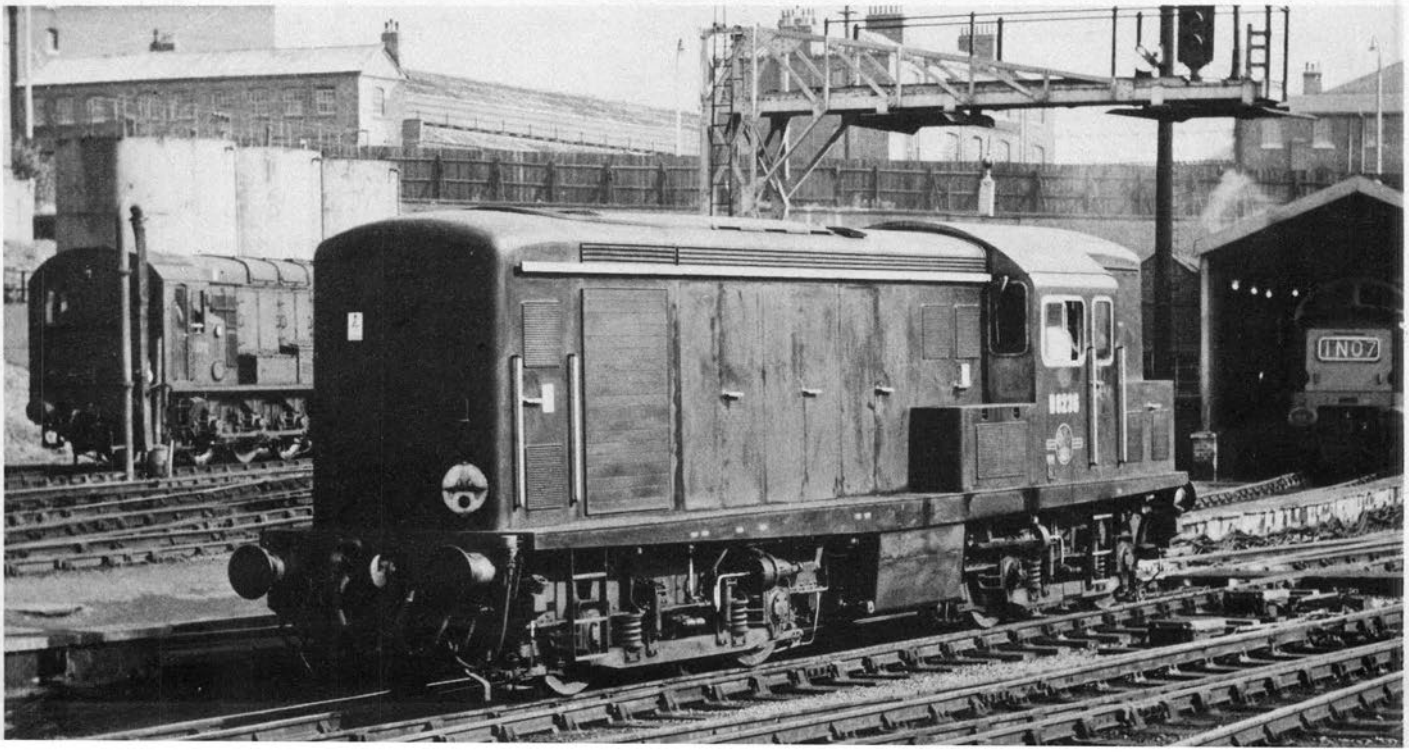
Details of Nos D8210-D8243

Engine: Paxman 16YHXL
No of cylinders and cycle — 16, four stroke
Max cont rated output — 800hp at 1,250rpm
Main generator: British Thomson-Houston RTB 10858
Traction motors: Four British Thomson-Houston 137BZ
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 39,500lb at 25.9% adhesion at 2,280A main generator
Cont tractive effort 20,000lb at 11.5mph at 1,320A main generator
Rail hp at cont rating — 593
Full engine output — available between 6 and 58mph
Braking: Air for loco, vacuum for train giving a brake force of 75.38% of loco weight in working order
Speed: 60mph (max permitted service)
Curve: 4 chains min rad curve without gauge widening, at dead slow speed
Train heating equipment: Not fitted
Tank capacities: Engine fuel — 400gal

As part of the general headlong plunge into quantity production of diesel locomotives, when the pilot scheme was abandoned, the British Thomson-Houston Co and the Clayton Equipment Co received orders for 34 more of the BTH type 1 800hp Bo-Bo design, of which 10 pilot scheme locos had initially been constructed. Although carrying the same Paxman 16YHXL diesel engine as had been fitted to the North British Loco Co version of the pilot scheme Type 1 (the D8400 class), it seems to have been regarded as a marginally better design than the latter, which received no follow-on orders. In some respects one wonders whether there was really much to choose between them!

As described in book one of this series, the Paxman engine and power unit was the chief cause of failure, being officially described (in internal reports) as 'unsatisfactory and dirty', and the engine suffered piston seizures and required excessive maintenance. There were fires in the engine room, and both these 'hood' unit designs suffered from poor visibility from the cab, especially with the engine bonnet leading.

In an attempt to get the best out of both classes they were all allocated to one Region — the ER — which involved transferring some of the D8200s from the LMR. The BTH/Clayton version seems to have been preferred for station pilot and empty stock work, in addition to the cross London transfer freights and similar duties on the ER in the London area, on which both types worked as intended.



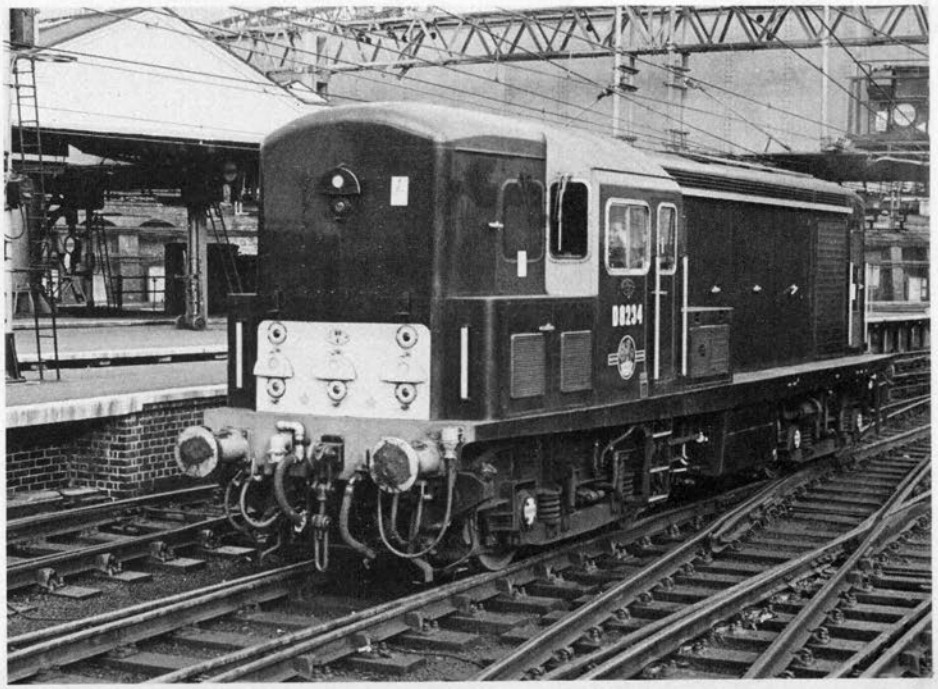
A delay of approximately one year took place between the delivery of the last pilot scheme locomotive No D8209 and the first production version, No D8210. This must have been due to restricted manufacturing resources because the production version was virtually identical in all respects (except for a later 'mark' of traction motor) and no fresh tooling-up was required. No D8210 was completed in October 1958 and Clayton delivered the last of the batch, No D8243 in February 1961.

Even whilst deliveries of the final locomotives was occupying their workshops, the Clayton Equipment Co was collaborating with BR on a replacement design, with fundamental differences, and the first of these — the standard class D8500 centre-cab Type 1 — appeared in September 1962. A description of this class appears in Section 9. A good-looking locomotive, the D8200 class (scheduled to become Class 15) was a victim of the National Traction Plan and only lasted for a decade or so in service. None have been preserved, but two still survive as non self-propelled pre-heating units, as follows: No ADB968000 (D8243), and ADB 968001 (D8233). A third, No ADB968002 is withdrawn, but still intact, (formerly No D8237).

Left: Station pilot duties occupy BTH Type 1 Bo-Bo No D8236 at Kings Cross. Externally there was no difference between the pilot scheme batch of 10 and the subsequent production batch. *P. J. Sharpe*

Above: A BTH Type 1 photographed on a cross-London freight at Gospel Oak Junction, whilst allocated to the LMR, at Devons Road shed. No running number visible, but the Bo-Bo is evidently in brand new condition. The livery was dark green with pale blue/grey cab ends and red bufferbeams; bogies and undergear were black. The handrails were of rectangular section and finished in bright aluminium. *British Rail*

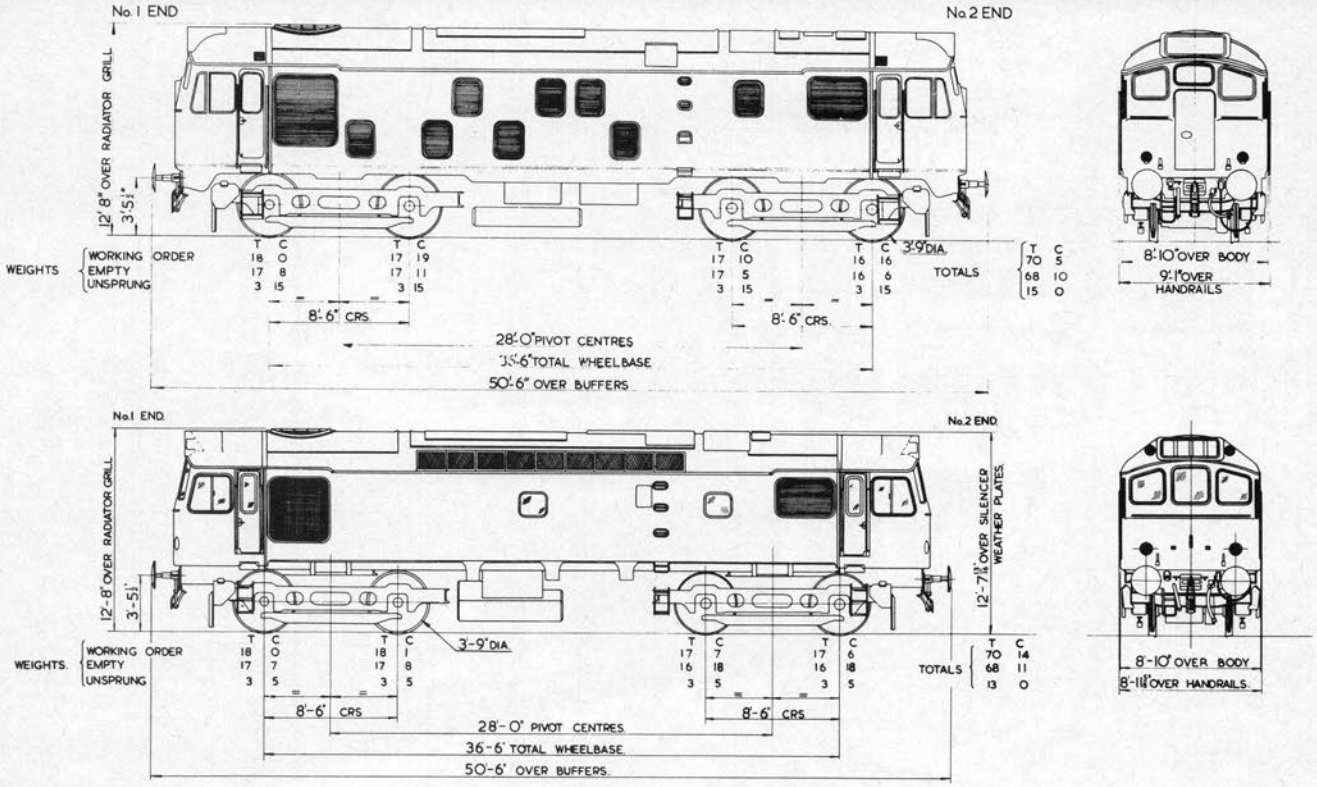
Right: The Liverpool St station pilot, No D8234, in smart condition with the small yellow warning panel added. None of the BTH Type 1 Bo-Bos were altered to carry four panel route indicators. Photographed January 1965. *John E. Hoggarth*



Top: Five years later, the same locomotive is seen at the same location. No 8234 on Liverpool Street station pilot duties. Although still in green livery, the locomotive now has complete yellow ends and (incorrectly) carries the BR arrow symbol. The 'D' prefix to the number has been painted-out, following the official decision to cease using this identification for diesel locomotives. Somewhat immodesty, No 8234 carries the Royal train headcode, with all four white marker discs displayed! In the background Brush Type 4 Co-Co No 1778 stands at the head of the 10.30 Norwich express; photographed on 3 September 1970. *G. R. Mortimer*

Above: Three of the BTH Type 1 Bo-Bos have survived the wholesale slaughter of the class that took place under the National Traction Plan. No longer used as motive power however, they have become 'train pre-heating units' — unable to be propelled by themselves — and they carry Departmental stock numbers (retaining differing shades of green livery). No DB 968002, formerly No D8237, is seen here at Finsbury Park and has since been withdrawn. *Barry J. Nicolle*

3 British Railways/Sulzer 1,160*/1,250hp Bo-Bo Type 2



Top: The drawing depicts the first of the 1,250hp (Class 25/0 today) versions, with revised original style bodysides, with air intake grilles changed in layout and roof mounted headcode box. No train heating boiler fitted. Gangway doors retained in the front ends.

Above: The final, completely revised design (Classes 25/2 and 25/3), with air intake grilles at roof level and no gangway doors in the front ends. Air horns combined with roof mounted route indicator; no train heating boiler.

Class: BR Type 2, later Class 25
Purpose: Mixed traffic locomotives
Introduced: 1961 (development of pilot scheme design)
Original numbers: D5151-D5299, D7500-D7677
Total built: This version; 327 (Grand total of 477 including 20 pilot scheme; Class 24)

Details of Nos D5238-D5299‡, D7500-D7567‡

Engine: Sulzer 6LDA 28B
No of cylinders and cycle — 6, four stroke
Max cont rated output — 1,250hp at 750rpm
Main generator: AEI RTB15656
Traction motors: Four AEI type 253AY
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 45,000lb at 28.7% adhesion at 2,340A main generator
Cont tractive effort — 20,800lb at 17.1mph at 1,300A main generator
Rail hp at cont rating — 949hp
Full engine output — available between 7.0 and 77.5mph
Braking: Air for loco, vacuum for train giving a brake force of 88.6% of loco weight in working order
Speed: 90mph (max permitted service)
Curve: 4½ chains without gauge widening, at dead slow speed.
Train heating equipment: Not fitted to these particular batches‡
Tank capacities: Engine fuel — 560gal

‡Specimen batches, as built. Considerable variation exists within Class 25; see text.

Whisper it who dares, but these BR Derby-designed Type 2s were a little inferior in concept and manufacture to their BRCW Co cousins! It was to take some considerable effort on Derby's part to redesign them, in the midst of quantity prduction, to match the similarly powered Sulzer-engined Bo-Bos built at Smethwick, and 150 examples were already ordered and constructed before these improvements even began to make themselves apparent. It was then to be a step-by-step affair before a really satisfactory design was evolved. It is no coincidence that *all* the original 150 locomotives, the Class 24 of latterdays, have now been withdrawn. They were decidedly inferior in bodywork design and the awkward internal engine room layout gave many a headache to maintenance men. For the drivers, they had a bad reputation because of their cramped and draughty cab layout, and many a 'homemade' remedy was applied to the cab walls, using masking-tape and suchlike in attempts to get rid of these draughts!

A particular weakness of the BR design was the location of the engine room air intake louvres, and filters, which were in the main bodyside area, whereas the BRCW Co version had them above the cant rail level. The BR version of the filters got so filthy in day-to-day service that the ones on the lower bodyside no longer prevented dirt from entering the engine room. Derby redesigned the layout of body to match the BRCW Co version, but only after far too many of the original design had been constructed. It was a good example of the price that had to be paid in abandoning the pilot scheme!

The whole of the now virtually extinct Class 24, originally Nos D5000-D5150 were to the pilot scheme design with 1,160hp Sulzer engines and British Thomson Houston electrical equipment, with some slight changes to the generator from No D5050 onwards. These 151 locomotives had some detail variations, as follows: Nos D5000-D5019 (pilot scheme) and D5020-D5113 all had folding white headcode discs and marker lights, gangway connections in the front ends, and hinged valances at the lower edge of the bodyside. Nos D5114-D5150 had four panel route indicators in the roof above the cab, but retained the gangway connections; no hinged valances fitted.

Class 25 commenced with No D5151 and to begin with the same bodystyle was retained as on the final Class 24s. The main difference was the fitting of an up-rated

*For details of the 1,160hp version, later Class 24 see book one of this series.

5616

D 5031

Above: BR/Sulzer 1,160hp Type 2 Bo-Bo No D5065 passes through Crystal Palace (Low Level) with a freight from the GN line to Norwood Junction, via the Metropolitan Widened Lines and the Snow Hill curve and Tulse Hill; 23 August 1962. *Brian Stephenson*

Left: In ex-works condition one of the D5020-D5113 batch, BR/Sulzer Bo-Bo No D5031; basically identical to the pilot scheme locomotives, with 1,160hp engine. Headcode discs and front end gangway retained, and hinged valances along the lower portions of the bodywork; shaped over the bogies. The livery was dark green with off-white lining bands, mid-grey roof, red bufferbeams and black bogies and undergear. Nos D5020-D5113 became Classes 24/0, and 24/1; now withdrawn. *K. L. Cook*

1,250hp Sulzer engine with on Nos D5151-D5175, the same BTH traction motors. However all the rest of the Class 25s were given AEI traction motors, and were geared for 90mph instead of 75mph. Nos D5151-D5232 and D7568-D7597 were built to the original bodystyle, complete with gangway doors and roof-mounted headcode boxes. Then the redesigned body, clearly based upon the BRCW version, was introduced. This was carried by Nos D5233-D5299, D7500-D7567 and D7598-D7677. The front end was changed as well as the bodysides, and there was no gangway doors. The headcode box had the air horns mounted one each side (a feature applied to the final examples of the old body style as well; see picture of No D7598). With this redesigned body, a new and attractive two-tone green livery was at first applied; the last to be built appearing new in rail blue livery however. Some batches were built specifically for freight use and no train-heating boiler or water tank was fitted. Ballast weights were added to keep the overall axle-loading even; these locomotives being easily identified by the space between the bogies which normally housed the boiler water tank.

The two classes were built by three BR workshops as well as private industry, as follows:

Nos D5000-D5019 (pilot scheme)	Derby
Nos D5020-D5029	Derby
Nos D5030-D5065	Crewe
Nos D5066-D5075	Derby
Nos D5076-D5093	Crewe
Nos D5094-D5113	Darlington
Nos D5114-D5150	Derby
Nos D5151-D5185	Darlington
Nos D5186-D5222	Derby
Nos D5223-D5232	Darlington
Nos D5233-D5299	Derby
Nos D7500-D7577	Derby
Nos D7578-D7597	Darlington
Nos D7598-D7623	Derby
Nos D7624-D7659	Beyer Peacock
Nos D7660-D7677	Derby

Beyer Peacock was in fact to have built the final batch, Nos D7660-D7677 as well, but by then the firm — a giant in steam days — was literally going out of business and did not wish to complete the order. This was a thousand pities, because it is generally recognised that the D7624-D7659 batch are the best of all the Class 25s in terms of workmanship and finish.

The two classes have been allocated to all Regions of BR at some time or other (except the Class 25s; not on the SR and the 24s, not

on the WR) and today the Class 25s are on the ScR, LMR and WR in strength. The WR started to receive Class 25s in 1971 to replace the Type 2 diesel-hydraulics and later the 'Hymeks', and the ER lost all its allocation in the course of the National Traction Plan motive power reshuffle which attempted to rationalise the number of types operating in any one area, or Region. To keep the class running many spares and components are stripped from withdrawn locomotives. Withdrawals are fairly steady, and usually depend upon the estimated cost of repairs being too high; the entire class is expected to have gone by 1986. Two examples of Class 24 have been preserved, Nos 24.032 (D5032) and 24.081. Three others remain in BR Departmental use, Nos 24.061 which has become No 97.207 and carries the name *Experiment*, and is operational, and Nos 24.054 and 24.142 which have become Nos TDB 968008/9; used as train pre-heating units, unable to be self-propelled.

Top left: Amidst the delightful scenery of Speyside, No D5132 ambles along on the 14.00 Craigellachie-Aviemore pick-up freight, on 20 June 1967. This Class 24/1 locomotive is one of the D5114-D5150 batch with roof mounted headcode box, retaining gangway doors in the front ends. Yellow warning panel added to original livery. No valances along lower edge of the bodysides, but bufferbeam trim retained. *John M. Boyes*

Left: From No D5151 onwards the Sulzer engine was uprated to 1,250hp, and some detail changes were made to the bodysides with redesigned cab doors, and no valances along the lower edge or trim, behind the bufferbeams. The air horns were located each side of the rooftop four panel route indicator box; making a rather top-heavy appearance. Although rarely used the gangway doors were still fitted. No D7596 was fresh from Darlington works when this picture was taken in 1964. The 1,250hp locomotives are todays Class 25/0,/1,/2 and/3. The engine seen here is a Class 25/2. *Ian Allan Library*

Top: The final development of the BR/Sulzer Bo-Bo entailed complete redesign of the bodywork, with the air intake grilles sited in the roof over the engineroom, and with no gangway doors in the front ends. This much neater and more efficient arrangement was enhanced by a two-tone green livery (as applied to the Brush Type 4s) with the yellow warning panel neatly incorporated. Two brand new locomotives, Nos D7502 and D7505 are seen double-heading a southbound load of coal past Whiteacre on 28 November 1964. These are Class 25/3 today, without train heating boilers. *Gerald T. Robinson*

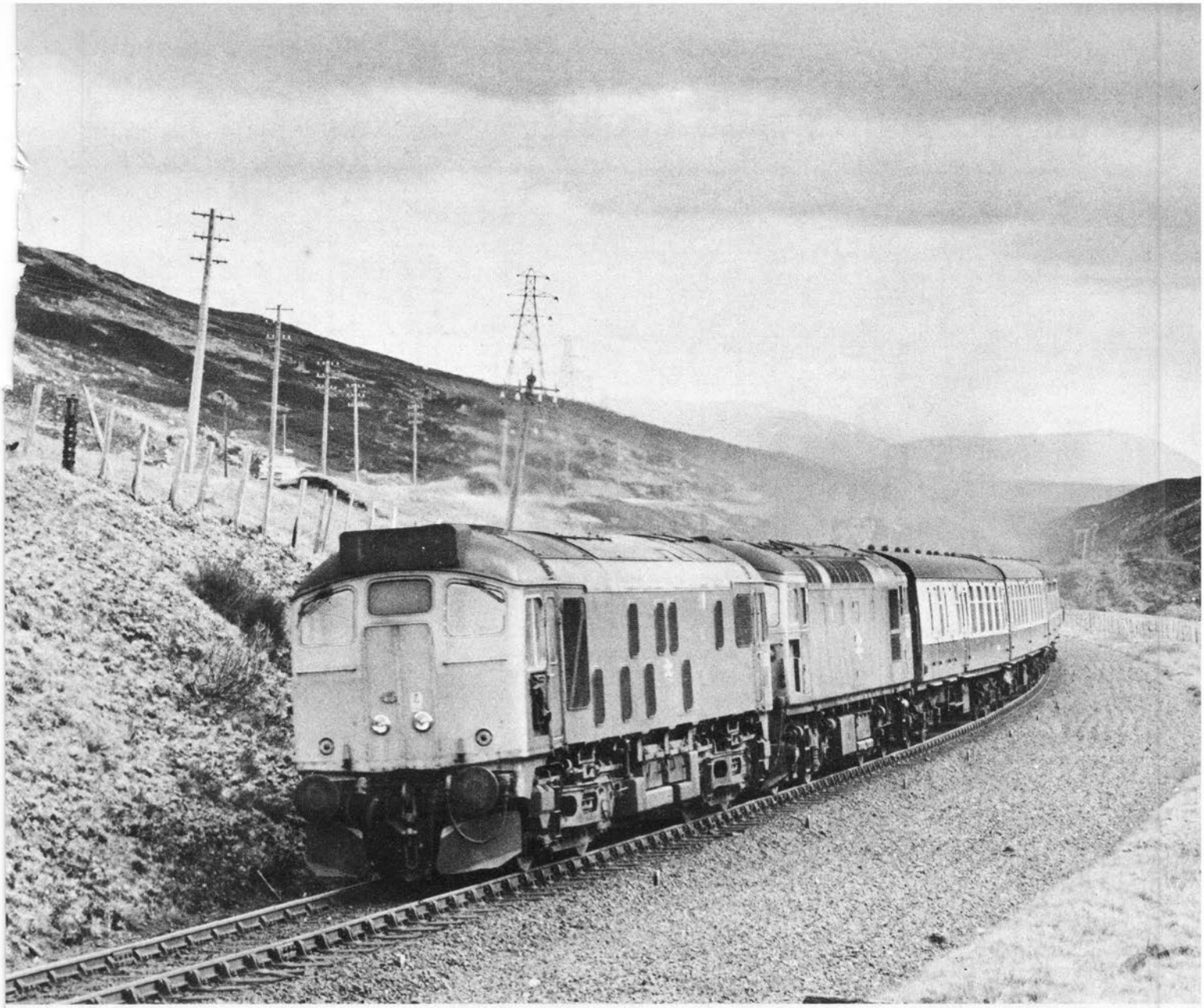
Above: The new livery certainly gave the final batch of BR locomotives more style, although the front end design still left a lot to be desired. With the lower bodyside shorn of all valances and trim, an almost austerity appearance was given to the bogies and undergear. This example, No D7618, has a large space between the bogies because it does not have a train heating boiler, and therefore is without the underslung water tanks; today's Class 25/3. *P. Berry*

Above: The change to rail blue livery did not improve the appearance of the later BR/Sulzers. In the earliest applications the blue was of a semi-matt finish (as seen here) and soon became very drab indeed. No D7667 was incidentally the 1,000th main line diesel-electric locomotive to be built by Derby works, and appeared in January 1967. Note the two BR symbols each side, one on each cab, and numbers behind the cab doors. The roof was painted blue, and the bogies, bufferbeam and undergear black; plus full yellow warning ends. *British Rail*

Below: Once a gloss paint finish was substituted, the BR blue livery looked considerably smarter, and in fact here it positively sparkles! Groomed to perfection. BR/Sulzer Type 2 Bo-Bos (Class 25/2 with boilers fitted) Nos 25.221 and 25.222 are seen at Spring Branch shed being prepared for Royal Train duties on 20 June 1977. BR symbol now located on centre of bodyside, and numerals on cabside (one end only). Gangway doors sealed-off and plated over on the front end of No 25.221, a measure taken to improve cab comfort by reducing draughts now that the gangways are never used. *Eric Bullen*

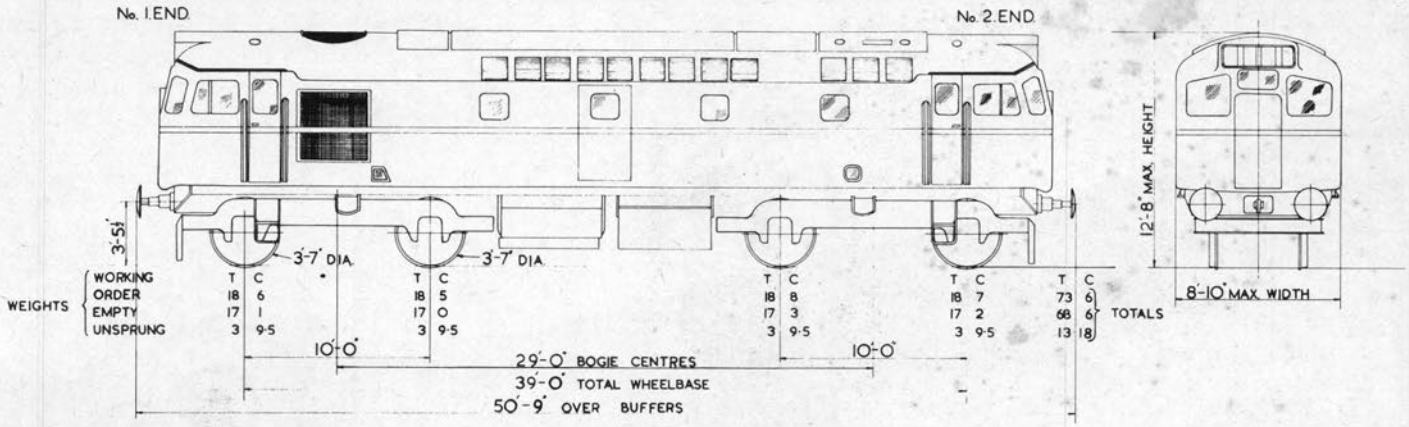
Right: Twin headlights in the centre of the front end (with the gangway doors sealed-off) characterise a Highland Section BR/Sulzer, No 5128 (Class 24/1 with boiler) seen here double-heading with BRCW Type 2 No 5344 on the 9.45 Glasgow-Inverness train climbing to Druimuachdar, near Dalnaspidal on 29 April 1971. Small snowploughs fitted and tablet catcher in recess on cabside. Four panel route indicator no longer in use, but still fitted with blinds. *J. H. Cooper-Smith*

Below right: Now all the Class 24s have gone, the BR/Sulzer design is represented only by the later Class 25s, and one in typical present-day condition is seen here, No 25.107; photographed at Nottingham, 29 July 1977. The former four panel route indicator box has two marker lights installed behind the glass. *N. E. Preedy*



25 107

4 Birmingham Railway Carriage & Wagon Co 1,160*/1,250hp Bo-Bo Type 2



Class: BR Type 2, later Class 27
Purpose: Mixed traffic locomotives
Introduced: 1961 (development of pilot scheme design)
Original numbers: D5347-D5415
Total built: This version: 69 (Grand total of 116 including 20 pilot scheme; Class 26)

Details of Nos D5347-D5415

Engine: Sulzer 6LDA28B
No of cylinders and cycle — 6, four stroke
Max cont rated output — 1,250hp at 750rpm
Main generator: GEC WT981
Traction motors: Four GEC Type WT459
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 40,000lb at 24% adhesion at 2,800A main generator
Cont tractive effort — 25,000lb at 14mph at 1,940A main generator.
Rail hp at cont rating — 933hp
Full engine output — available between 7.5 and 80mph.
Braking: Air for loco, vacuum for train giving a brake force of 78.6% of loco weight in working order
Speed: 90mph (max permitted service)
Curve: 5 chains without gauge widening. 4½ chains at dead slow speed
Train heating equipment: Stone Vapor with a steaming capacity of 1,750lb/h
Tank capacities: Engine fuel — 500gal
Boiler fuel — 100gal
Boiler water — 450gal

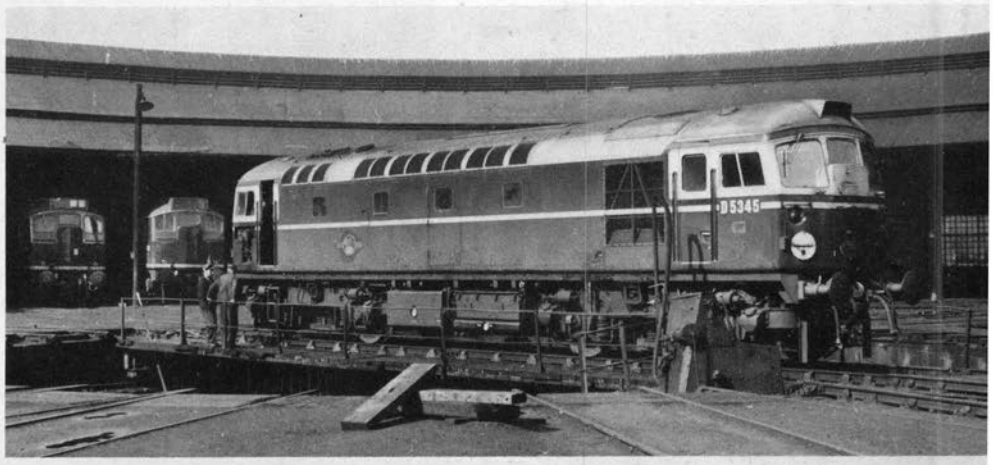
This was one pilot scheme design over which BR did not hesitate about when ordering further production locomotives, and it featured early on in these orders with 26 basically identical locomotives following-on from the 20 pilot scheme examples. Nos D5320-D5346 had modified bogie suspension, with all helical springs replacing the original combination of leaf and helical, and the overall weight was reduced from 78 to 73 tons in working order. This desirable weight reduction was achieved by fitting round-headed lightweight Oleo-pneumatic buffers, in place of the normal oval type and by a reduction in water tank capacity; plus one or two other minor detail changes. The traction motors were of slightly modified design; the Sulzer diesel engine and the generator remaining the same. The last of these 46 locomotives, nowadays known as the Class 26 Bo Bos, was delivered by BRCW in November 1959, and all of them, including the pilot scheme batch which was originally in the ER London area, were allocated to the Scottish Region; where they were very well received. (When new, Nos D5330-D5335 were loaned to the ER for GN suburban services for a while, due to the continuing unreliability of some of the other pilot scheme Type 2 designs inflicted upon the ER!)

The BTC soon desired increased horsepower for its Type 2 locomotives, which truth be known were somewhat underpowered in some instances for the weight they were dragging around with them, and the Sulzer engine was a candidate for uprating in both the BR and the BRCW versions. A further batch of Bo-Bos was accordingly ordered from BRCW, with 1,250hp Sulzer 6LDA28-B engines and with GEC electrical equipment; this latter change was because Crompton Parkinson could not take on extra work at the time. This final batch, the Class 27s, was geared for an increased maximum speed of 90mph. Their original BR numbers were D5347-D5415, and they were delivered between July 1961 and November 1962; going initially to the ScR (Nos D5347-D5369) and then the NER (D5370-D5378, without train heating boilers) and the remainder, Nos D5379-D5415, to the LMR Midland lines. Eventually the entire class gravitated to Scotland, as part of the BR motive power rationalisation policy of 1970.

It was this same year, 1970, that witnessed the ScR undertaking tests for a push and pull high speed service between Edinburgh and Glasgow, made in conjunction

Above: The drawing depicts the later production version of the BRCW Co Type 2 Bo-Bo, with 1,250hp Sulzer engine, and roof-mounted four panel headcode box; now Class 27. See book one of this series for a drawing of the 1,160hp version; now Class 26.

Below: BRCW Type 2 No D5345 is being turned on the turntable at Inverness shed, with two BR/Sulzers seen inside on the left. Basically similar to the pilot scheme locomotives in appearance, two ScR modifications can be seen: the recess for the single line tablet catcher (on the rear cab in this picture) and the sliding type cabside windows. Livery was dark green with off-white lining and cab window area, mid grey roof, red bufferbeams and black bogies and undergear. *P. H. Groom*



*For details of the 1,160hp version, later Class 26, see book one of this series.

with the Research Department at Derby. These tests were made with Co-Co locomotives of Type 3 (Class 37) and Type 4 (Classes 47 and 50) power, but in the event such powerful locomotives could not be released from the other Regions where they were allocated, and the ScR opted for an alternative idea, whereby *two* type 2 Bo-Bos worked each train; one each end of the formation of Mark 2 carriages. The 90mph Class 27s were selected, and 12 (half of the required number) were suitably overhauled and modified at Derby works in the autumn of 1970. These were given electrical train heating, by means of a small Deutz diesel engine and generator; the steam heating being removed. The other 12 locomotives required for the service were dealt with at St Rollox, and retained steam heating. All the locomotives were given dual-braking, automatic fire-fighting equipment, and driver to guard communication. These overhauls included attention to the traction motors, but unfortunately the intensive day-in day-out high speed running required soon began to reveal some faults; and flashovers occurred. The bogie suspension also required fresh attention and the bodies had stress problems. The main generators gave persistent trouble but the engine itself continued to perform very well. Eventually the Class 27/1 (steam heating) and Class 27/2 (electrical train heating) Bo-Bos were released from these onerous duties by the arrival of the Class 47/7 push and pull Brush Co-Cos.

A gradual run down in numbers is planned for the Class 26 locomotives over the next few years, and the Class 27s will probably be halved in numbers by 1991. The transfer of some more EE Co Class 37 Co-Cos has now further eased the motive power situation in Northern Scotland, when these BRCW Type 2s have performed such sterling work for the past two decades. Recently there have been a number of cases of Class 27s catching fire, but repairs seem to be justified, rather than withdrawal, at least at the time of writing.

Top: The ScR cab window layout is well seen in this view of No D5351, taken at Fort William on 4 July 1962. Also the recess for the cabside tablet catcher. This is one of the batch Nos D5347-D5415, with uprated 1,250hp engines (now Class 27) and has a four-digit route indicator neatly incorporated in the cab roof, and modified bogie suspension (see text). Small snowploughs fitted. *M. Pope*

Above: No D5379 is seen at St Pancras when brand new, at the head of a Tilbury Boat Train, on 27 April 1962 — the first appearance of one of the class at St Pancras. Nos D5379-D5415 were at first allocated to the LMR. Small detail changes are the droplight-type cabside windows, and the addition of yellow warning panels to the livery. Note the steam-heating boiler in operation. *A. Swain*

5329

100
5413

Top left: Some ScR Bo-Bos were repainted in an incorrect version of the corporate identity blue livery to begin with. The yellow on the ends should have been carried round to the cabsides at the window level. No 5329 (without D prefix) is in the drab semi-matt blue paint finish; seen here at Edinburgh Waverley on 18 July 1970. *David Wharton*

Left: Gloss paint finish and correct livery look very smart on No 5413, also photographed at Edinburgh; on 27 July 1971. This is one of the locomotives converted to push and pull working for the Edinburgh-Glasgow services, and has electrical train heating fitted (note the jumper head receptacle on the driver's side of the cab front). *David Wharton*

Above: The ScR has never attempted to replace the original marker discs and headlights of the earlier locomotives, and they still carry these headcodes (thus having outlived the era of the four digit route indicators). On No 5341, seen shunting at Kyle of Localsh on 30 May 1972, the gangway doors have been removed and plated over, and a baffle plate added to the air horns grille on the cab roof. The layout of the snowploughs is well depicted. In the background can be seen the MacBraynes' steamer alongside. *J. H. Cooper-Smith*

Above: Although this book is concerned with the post-pilot scheme locomotives, one development affecting the earlier locomotives deserves mention. The first seven of the pilot scheme batch was converted to work 'merry-go-round' coal trains. The train heating boilers were removed and also the boiler fuel water tanks. The space left by the tank was utilised for an air compressor. Slow speed control was fitted, also air brakes in addition to the existing vacuum brake for train working. No 26.002 is illustrated; photographed on 20 April 1976. Note that the pilot scheme locomotives had oval buffers (all the production batches having round ones) and on this example the cabside door windows have been plated over, and the front end gangway removed. *Barry J. Nicolle*

Above right: Another example of a Class 26 (a production version) with the cabside door windows plated over. No 26.035 also carries twin headlights in the front ends (gangway door welded-up) and small snowploughs; painted yellow in this instance. The blue livery is the revised version with both the numerals and the BR symbol on the bodysides, between the cabs. Photographed at Inverness on 18 September 1977. *David Bailey*

Right: The plain front end appearance created by the removal of the gangway connections and doors is well depicted in this view of No 27.042 at the head of a Fort William–Cadder 'Speedlink' air-braked freight, seen entering Crianlarich station on 16 August 1977. Twin marker lights in the former four-panel headcode box. Despite a recent influx of Class 37 and 47 power on to the ScR these BRCW Class 27s seem well-fit to tackle the next decade or so. They have certainly proved to be one of the best of the pilot scheme designs. *T. H. Noble*

26035

5(a) Brush Traction Co 1,250*/1,365/1,600•/ 2,000hp† AIA-AIA Type 2/3/4†

Class: BR Types 2/3•/4†, later Class 30
Purpose: Mixed traffic locomotives
Introduced: 1957
Original numbers: D5500-D5519* (pilot scheme) D5520-D5699, D5800-D5862
Total built: 263 (including 20 pilot scheme)

Details of Nos D5520-D5699, D5800-D5862 (except •†):
Engine: Mirrlees JVS12T
No of cylinders and cycle — 12 four stroke
Max rated output — 1,365hp at 900rpm
Main generator: Brush TG160-48
Traction motors: Four Brush TM73-68
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 36,000lb at 22.3% adhesion at 2000A main generator (Nos D5535 onwards); originally 42,000lb at 26% adhesion at 2,000A main generator
Continuous tractive effort 18,800lb at 21.5mph at 1,200A main generator
Rail hp at continuous rating — 1,076hp
Full engine output — available between 9.7 and 76.6mph
Braking: Air for loco, vacuum for train, giving a brake force of 80% of loco weight in working order
Speed: (Max permitted service) — 80mph (Nos D5520-D5534) 90mph (D5535 onwards).
Curve: 4½ chains min rad curve without gauge widening, at dead slow speed
Train heating equipment: Spanner

*For details of Nos D5500-D5519 see book one of this series.

†No D5833 temporarily uprated with intercooled engine to 2,000hp; later 1,600hp.

•Nos D5545, D5655-D5670 uprated to 1,600hp.

Swirlyflow with a steaming capacity of 1,500lb/h
Tank capacities: Engine fuel — 500gal
Boiler fuel — 100gal
Boiler water — 600gal

In July 1958 Brush received an order for 40 more Type 2 A1A-A1As, to the same basic design as their pilot scheme locomotives, which had been well accepted on the ER. At this time the last seven of the 20 pilot scheme diesels were still under construction at Loughborough, and the production order was phased-in to follow-on very smartly. The last pilot scheme locomotive, No D5519 was delivered in December 1958, and the first production locomotive, No D5520 in February 1959. One difference was the uprating of the Mirrlees engine to 1,365hp, and another the change from an electro-magnetic multiple-unit control system to a standard electro-pneumatic system which allowed them to work with most other production version BR diesels in multiple (Nos D5500-D5519 could only work in multiple-unit with certain pilot scheme types). With the uprated engines, larger main generators and traction motors were used.

The external appearance was slightly modified on Nos D5520-D5529 because the cab window surround was painted green instead of eggshell blue, or blue/grey (which was still used for the lining bands). Then on No D5530 two important changes were made. The folding headcode discs were replaced by a roof-mounted four panel route indicator, and the lining bands were changed to an off-white colour. Due to production difficulties, some later locomotives of this batch still received the headcode discs; those recorded are: Nos D5535/9/43/7/8/51/2/5/— 6/9/62. Top speed of the locomotives was raised to 90mph commencing with No D5535.

Even before No D5520 took to the rails a further production order for 20 locomotives had been placed in December 1958, and with further orders following on steadily the class was eventually to total 263 by October 1962. The 1,365hp rating evidently did not satisfy BRs thirst for more powerful mixed traffic locomotives, (by then the desirability of a Type 3 power range had been recognised) and No D5545 had its Mirrlees engine uprated to 1,600hp using oil-cooled pistons with an increased engine speed of 950rpm, as an experiment.

Brush managed an output of two locomotives per week for BR for most of the time, and the impact of these deliveries was soon felt on the ER, particularly in East Anglia, where steam traction was rapidly replaced. The Brush Type 2s established such an excellent reputation that it seems BR were confident that they could become Type 3 power for future building; accordingly Nos D5655-D5670 were delivered with 1,600hp engines. Then BR set their sights even higher — with no less than 2,000hp provided by an intercooled Mirrlees engine temporarily fitted to No D5835 — thereby making it a Type 4 locomotive! Trials were

Below : Although the production batches were very similar in appearance to the pilot scheme designs the change to a four panel route indicator soon after production began affected their front end appearance. The two versions are seen here on Nos D5539 and D5579 at Liverpool Street. Although difficult to realise from this monochrome photograph, the locomotive on the right, No D5579 is painted in an experimental golden yellow livery, with off-white lining band. This was part of a visual warning trial (see next picture) intended to make locomotives more visible to men working on the tracks. It was as a result of these experiments that the yellow warning panels were painted on the ends of all locomotives and multiple-units. *British Rail*

undertaken whilst based in the Sheffield area, including main line express passenger trains to Kings Cross, which were normally worked by 'Deltics', and it seems to have proved a success. But a dramatic change of events was to prevent these uprated locomotives from being further developed, when after some five years in service, the earlier examples of the 1,365hp version of the Mirrlees engine began to develop fatigue problems. (This was discovered at approximately $\frac{1}{2}$ million miles of running).

Metal fatigue was occurring on the fabricated engine housing and cylinder columns, (similar fatigue was later found on some Brush/Mirrlees locomotives which had been exported to Rhodesia). Needless to say these problems would in due course have affected the more recent 1,600 and 2,000hp versions, and it was evident that up-rating was partly to blame because the original pilot scheme engines — rated at 1,250hp — soldiered on in service to achieve 11 years or more before replacement.

The crisis for BR was one of locomotive availability. No doubt the Mirrlees engines could be repaired or rebuilt and the fatigue problem solved (as was to prove to be the case in Rhodesia), but meanwhile expensive locomotives would be forced to lie idle — losing revenue-earning service — because there were no spare engines to replace those

Above: Also in connection with the visual warning trials Brush Type 2 A1A-A1A No D5578 was painted in 'electric blue', without any lining-out. This was the colour then being applied to the new LMR 25Kv electric locomotives; hence the name.
M. G. Martin

Below: No D5615 displays the standard livery for the production series Brush Type 2s: dark green with off-white lining (but no white around the window areas) and mid grey roof; red bufferbeams and black bogies and undergear. Photographed at Kings Cross.
J. B. Bucknall.

removed for repair or rebuilding. The solution that BR came up with was a remarkable one and it showed the changing mood that existed within BR engineering circles, following years of battling to try and get a reliable diesel fleet together from the mixed collection of types that had been all too hurriedly put into production when the pilot scheme was aborted.

During a visit to Doncaster works for overhaul in 1964, No D5677 had its troublesome Mirrlees engine removed and replaced by an English Electric 12-cylinder 12SV engine, rated at 1,470hp. So successful was this that, after trials in early 1965, a further 49 EE Co engines were ordered to replace at random those Mirrlees engines needing heavy repairs. This order was soon replaced by one for new engines for the *entire* class! The Mirrlees engines were (as recounted in book one of this series) sold back to the manufacturer, who reconditioned them for further use, including marine work in trawlers. All the Brush Type 2s (including the up-rated locomotives) were re-engined between 1965-69, with the original pilot scheme batch of locomotives being the last to be dealt with. To match the capacity of the existing generator, the EE Co 12SV engine was limited to 1,470hp — somewhat less than its true capacity. This has had the beneficial side-effect of giving long-life and increased reliability; a characteristic of the thousands of engines produced by this company for use on BR.

In their re-engined form the Brush locomotives have remained one of the mainstays of the 'maids of all work' portion of the BR fleet. Originally concentrated upon ER territory (having been briefly tried out in Scotland) the Class 31s, as they are nowadays known, have spread their wings to serve the WR and LMR in recent years; also reaching the SR on some cross-country duties.

Today the pilot scheme batch have all gone (except No D5500 which is officially preserved) and the 224 survivors are Class 31, with two main groups, the 31/1 and the 31/4. The latter are 24 locomotives fitted with both steam and electric train heating (Nos 31.401, 31.419-24 have the steam heating boiler isolated), and dual braking. Some of the Class 31/1s are also dual braked and some have no train heating boiler; being essentially for freight use.

Apart from the adoption of the standard blue livery with yellow ends, the most noticeable changes in recent years have been the removal of the gangway doors from many locomotives (to prevent cab draughts), the removal of the footsteps up the bodyside to the erstwhile roof-sited water tank filler, which was a requirements when steam locomotive water columns were still located at platform ends on ER stations, and the adoption of two marker lights in the former four panel headcode box.

Four withdrawn locomotives are now in Departmental stock as non self-propelled pre-heating units, converted from pilot scheme locomotives, as follows: Nos ADB 968013 (31.013), ADB 968015 (31.014), ADB 968016 (31.002) and ADB 968017 (31.006).

Top left: The small yellow warning panel was quite neatly incorporated in the Brush Type 2 livery scheme, as seen here on No D5830, working a down Great Northern outer suburban train; photographed leaving Potters Bar on 21 April 1962. *C. P. Boocock*

Left: The decision to extend the yellow area to the entire front end of locomotives and multiple-units was taken when the change of livery from dark green to rail blue was in progress. Some green locomotives received full yellow ends, as seen here on No D5520, and it certainly did not enhance their appearance! This locomotive also carries the new BR symbol despite an official ruling that it was only to be used in conjunction with the new blue livery. Photographed at March depot; 27 June 1969. *N. E. Preedy*

Above: Another 'unofficial' livery is sported by No 5557 photographed at Doncaster on 19 July 1971. Still in green, with mid-grey roof, off-white lining and full yellow ends. The positioning of the symbols and numerals is that first adopted for blue locomotives. *Terry Whitham*

Below: Some Brush Type 2s, of the production series appeared with the old-type front end, complete with headcode discs (see text). Here No 5559, in blue livery, is seen leaving Bedale on a train from Redmire to Tees Yard; October 1973. *S. Creer*

5(b) Brush Traction Co/English Electric Co 1,470hp AIA-AIA Type 2, (later Class 31)

As related in the text, the Mirlees engines were so troublesome that BR decided in 1964 to replace them all with English Electric 12SVT engines. The re-engined version became Class 31, and various sub-classifications have existed due to the fitting of air brakes and electrical train heating, or removal or isolation of the steam heating boiler. There is only space to give details of one version here, and I have chosen one variant of Class 31/2 as running in March 1973, with dual brakes and dual heating:

Details of Nos D5589/92/6, 5605/6/16/40/6/56/69, 5856:
Engine: English Electric 12SVT
No of cylinders and cycle — 12, four stroke
Max rated output — 1,470hp at 850rpm
Main generator: Brush TG160-48
Traction motors: Four Brush TM73-68
Type of suspension — nose

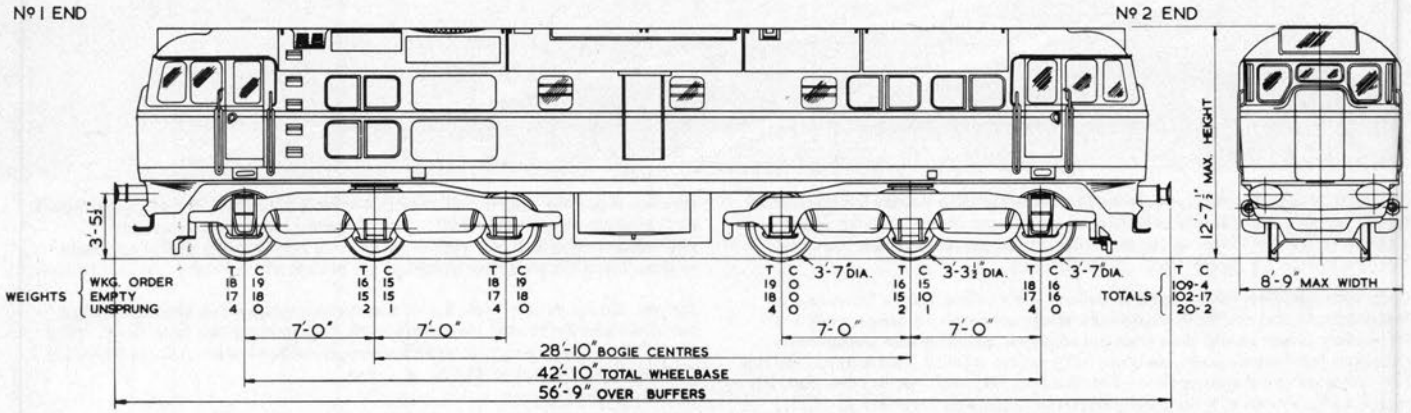
Below: The drawing depicts an example of Class 31/2, rebuilt with English Electric 1,470hp engine, and train heating boiler fitted; dual braked. Four panel headcode box added to cab roof.

Type of gear drive — single reduction
Performance: Max tractive effort — 35,900lb at 20.8% adhesion at 2,000A main generator
Cont tractive effort — 18,700lb at 23.5mph at 1,200A main generator
Rail hp at continuous rating — 1,170hp
Full engine output — available between 10.75 and 73.9mph
Braking: Straight air and auto air for loco, auto air and cont vac for train, giving a brake force of 75.4% of loco weight in working order
Speed: 90mph (max permitted service)
Curve: 4½ chains horizontal without gauge widening
Train heating equipment: Boiler: Spanner Swirlyflow with steaming capacity of 1,500lb/h
Electric Generator: Brush BL100-30, driven by main engine with cont output of 320KW at 870V.
Tank capacities: Engine fuel — 500gal
Boiler fuel — 100gal
Boiler water 600gal

Above right: Looking extremely smart, a pair of Brush Type 2s (now Class 31) speed through Sonning Cutting on a Birmingham-London express. The class have earned a good reputation for passenger duties, and are sometimes to be found working trains normally the province of Type 4 power. Blue livery with numerals at one end only, each side. *I. J. Hodson*

Below right: The telephoto lens emphasises the bulky load of oil tankers being hauled by a brace of Class 31s, Nos 31.185 and 31.138 at Hampstead Heath on the North London Line; 16 April 1980. The leading locomotive has had the gangway doors removed from the front end, and carries twin marker lights in the route indicator box. *M. J. Collins*

Below: A further livery variation has appeared on some London area locomotives, on both the WR and the ER (GN section) A white line is painted on the existing raised metal beading, in the same style as the original livery, but the lower white line is omitted. Class 31/4, No 31.402 was photographed at Canonbury Junction with empty sleeping car stock on 16 May 1979. *Les Bertram*



1V28

31105

6(a) North British Loco Co 1,000*/1,100hp Bo-Bo Type 2

Class: BR Type 2, later Class 21
Purpose: Mixed traffic locomotives
Introduced: 1958*
Original numbers: D6100-D6109* (pilot scheme) D6110-D6157
Total built: 58 (including 10 pilot scheme)

Details of Nos D6110-D6157

Engine: North British/MAN L12V/21BS
No of cylinders and cycle — 12, four stroke
Max cont rated output — 1,100hp at 1,500rpm
Main generator: GEC WT880A
Traction motors: Four GEC WT 440
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 45,000lb at 28% adhesion at 2,800A main generator
Cont tractive effort — 30,000lb at 10.2mph at 1,940A main generator
Rail hp at cont rating — 816hp
Full engine output — available between 5.2 and 64.0mph
Braking: Air for loco, vacuum for train, giving a brake force of 84% of loco weight in working order
Speed: 75mph (max permitted service)
Curve: 4½ chains min rad curve without gauge widening, at dead slow speed
Train heating equipment: Spanner Swirlyflow vertical boiler giving a steaming capacity of 1,500lb/h
Tank capacities: Engine fuel — 360gal
Boiler fuel — 100gal
Boiler water — 600gal

*For details of the 1,000hp pilot scheme version see book one of this series.

The limited experience gained with the 10 pilot scheme locomotives, Nos D6100-D6109, described in book one of this series, was evidently sufficiently promising to warrant a further production order for 28 locomotives, Nos D6110-D6137, with deliveries commencing in May 1959 and whilst work on these was in progress a follow-on order for 20 more was received. Nos D6138-D6157; making a total of 48 production examples, with the last being delivered to traffic in December 1960.

The official BR diagram book shows all the locomotives from Nos D6110 onwards to have been fitted with 1,100hp engines (the pilot scheme version had been 1,000hp) but recently some published sources have claimed that only the last 20, Nos D6138-D6157 were built with uprated engines. The 100hp difference was of no great significance in any case, but it brought the MAN engines into line with those being fitted to the WR 'Warship' class diesel-hydraulic Type 4s that North British was also building. One significant difference with the last 20 locomotives was the multiple-unit coupling method which was changed to the by then standardised 'blue star' electro-pneumatic system, whereas Nos D6100-D6137 were 'Red Circle' and could only work in multiple with a handful of pilot-scheme Types.

The MAN engines were of German design built under licence by North British , and they proved to be troublesome; indeed some former BR engineers have since voiced the opinion that they would have been better if purchased direct from Germany, thereby pointing a finger at poor manufacture. With all the class drafted to the ScR, the performance of the D6100s did not match that of the BR Sulzer and BRCW Type 2s in Scotland, and as a consequence BR decided to experiment with a different make of diesel engine, in the hope of improving their performance.

A suitable British made quick-running engine to match the existing GEC main generator (which was retained) was found in the Paxman 'Ventura' 12-cylinder engine, and so one locomotive, No D6123 was sent to Davey Paxman's Colchester, Essex works for re-fitting; which was completed by July 1963. The new engine gave 1,350hp and an increased maximum service speed of 80mph. Trials were undertaken in Scotland, and then authority was given for 19 more of the class to receive the 'Ventura' engines. These were selected from both the pilot scheme and production versions. Externally they differed in two respects from the MAN engined locomotives in that (except for No D6123) all had the front end gangway doors and marker discs and headlights removed and replaced by a four panel route indicator, and all received a two-tone green livery which, again except on No D6123 when first delivered, had a white line separating the two colours at waist level.

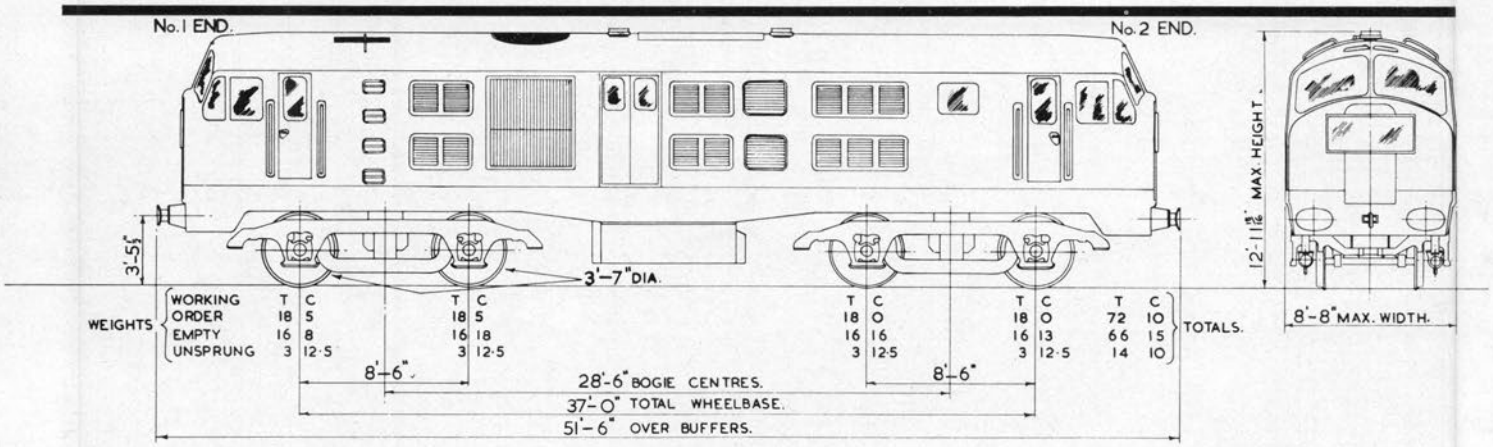
The Paxman locomotives became Class 29 in the BR renumbering scheme and the unaltered MAN engined locomotives Class 21. Under the National Traction Plan the 20 rebuilt examples were to be given a brief respite as they had shown themselves to be superior performers, but such a small quantity of locomotives was against the new policy of rationalisation of types, and although the unaltered locomotives were the first to go, with a mass withdrawal at the end of 1967, all the Paxman's followed them to the scrapyard in the autumn of 1971. One or two received blue livery, but none ever carried their new numbers. None have been preserved.

Left: In the picturesque setting of Fraserburgh shed, two NBL/MAN Type 2s stand at rest. Outside is No D6152, whilst just visible inside is No D6139; photographed on 15 July 1960. Basically similar in appearance to the pilot scheme version, the louvres to the main radiator were however slightly modified in design, and a recess was provided on the driver's cabside to take the tablet catcher. Livery was plain dark green, with mid-grey roof (between cabs only); red bufferbeam and black bogies and undergear. *John A. N. Emslie*

Top: A pair of NBL Type 2 Bo-Bos are seen hard at work on the 1.15pm Glasgow (Buchanan St) to Dundee train, passing St Rollox station on 2 November 1962. The leading locomotive is pilot scheme No D6109; the other is a production locomotive, No D6132. Yellow warning panels have been added to No D6109, and the modified radiator louvres, since built. A curiosity of these locomotives was the vertical hinging for the white headcode discs. *S. Rickard*

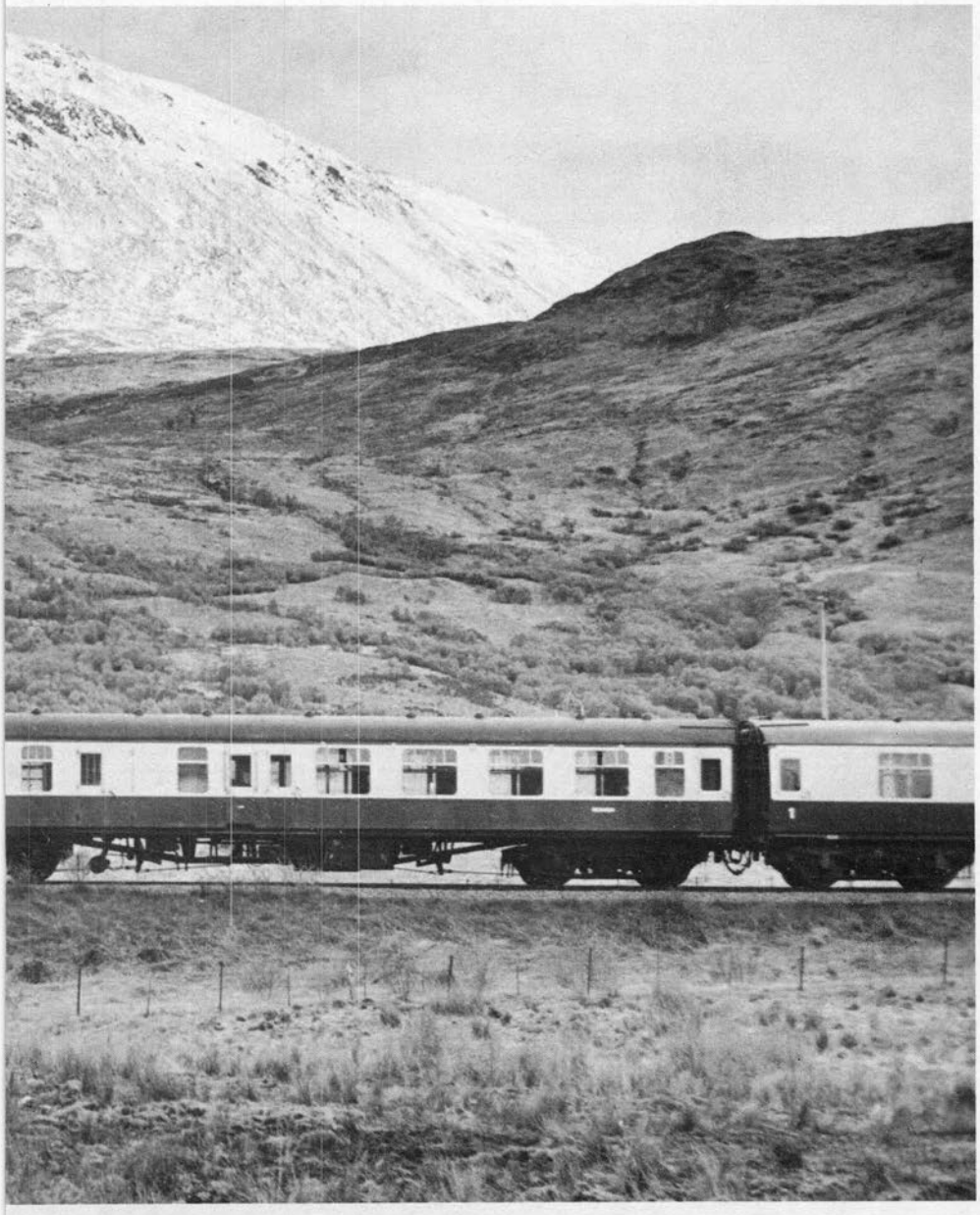
Above: Smoking unhealthily, NBL/MAN Type 2 No D6141 makes hard work of an Aberdeen-bound freight on 5 August 1964. Yellow warming panel and 25Kv overhead catenary signs added to the front end. Tablet catcher in recess on cabside. Problems with the engines were excessive and a solution was sought by replacing them with Paxman 'Venturas', but only 20 were done. *P. H. Wells*

6(b) North British Loco Co/Paxman 1,350hp Bo-Bo Type 2, (later Class 29)



Above: The drawing depicts the rebuilt 1,350hp version, with Paxman engine, and four panel route indicator fitted. (See book one of this series for a drawing of the original MAN version.)

Right: The 20 re-engined locomotives were easily identified by the two-tone green livery they carried, with a white line separating the dark green from the upper portion which was grey-green. A further modification was the fitting of four-panel route indicators and removal of the gangway doors. No 6132, with overall yellow ends, is seen hauling a brake van at Grangemouth Docks on 7 September 1971. Although they became Class 29 in the TOPS renumbering scheme, the Paxman-engined locomotives did not survive long enough to carry the new numbers. *Derek Cross*



Left: With Ben Nevis in the background, Paxman-engined NBL Bo-Bo No 6123 heads away from Fort William with the 16.15 to Glasgow on 8 May 1968. Even the fitting of the 1,350hp Paxman 'Venturas' did not save the class (those so-fitted) from withdrawal as part of BR's rationalisation of locomotive types.
C. W. R. Bowman

Severe engine problems with the MAN design led to BR fitting a Paxman 12YJXL to No D6123 as an experiment; a further 19 were subsequently rebuilt.

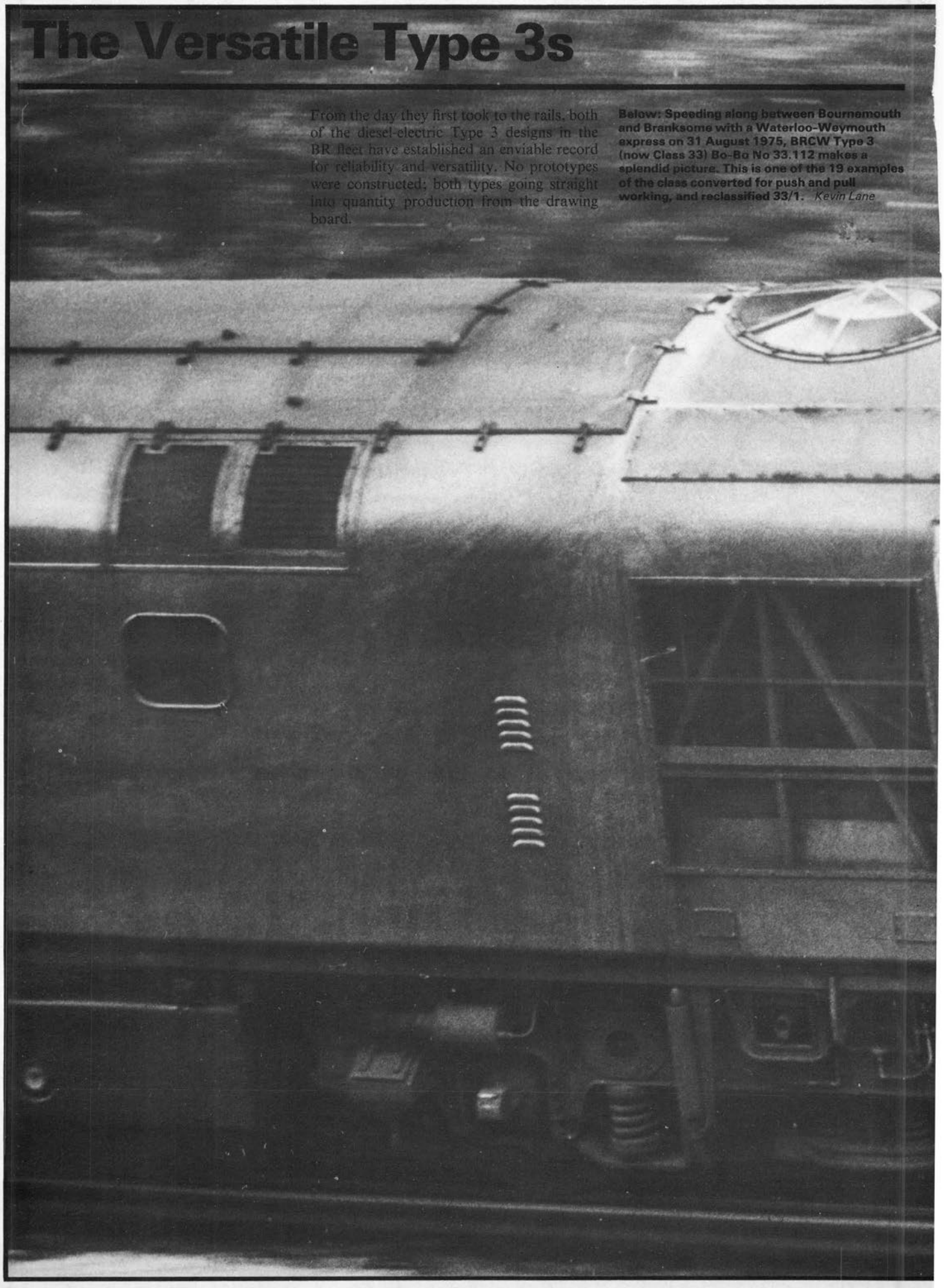
Introduced: 1963
Original numbers: D6100-3/6-8/12-14/16/19/21/3-4/9/30/2-3/7
Total rebuilt: 20

Details of the rebuilt listed above:

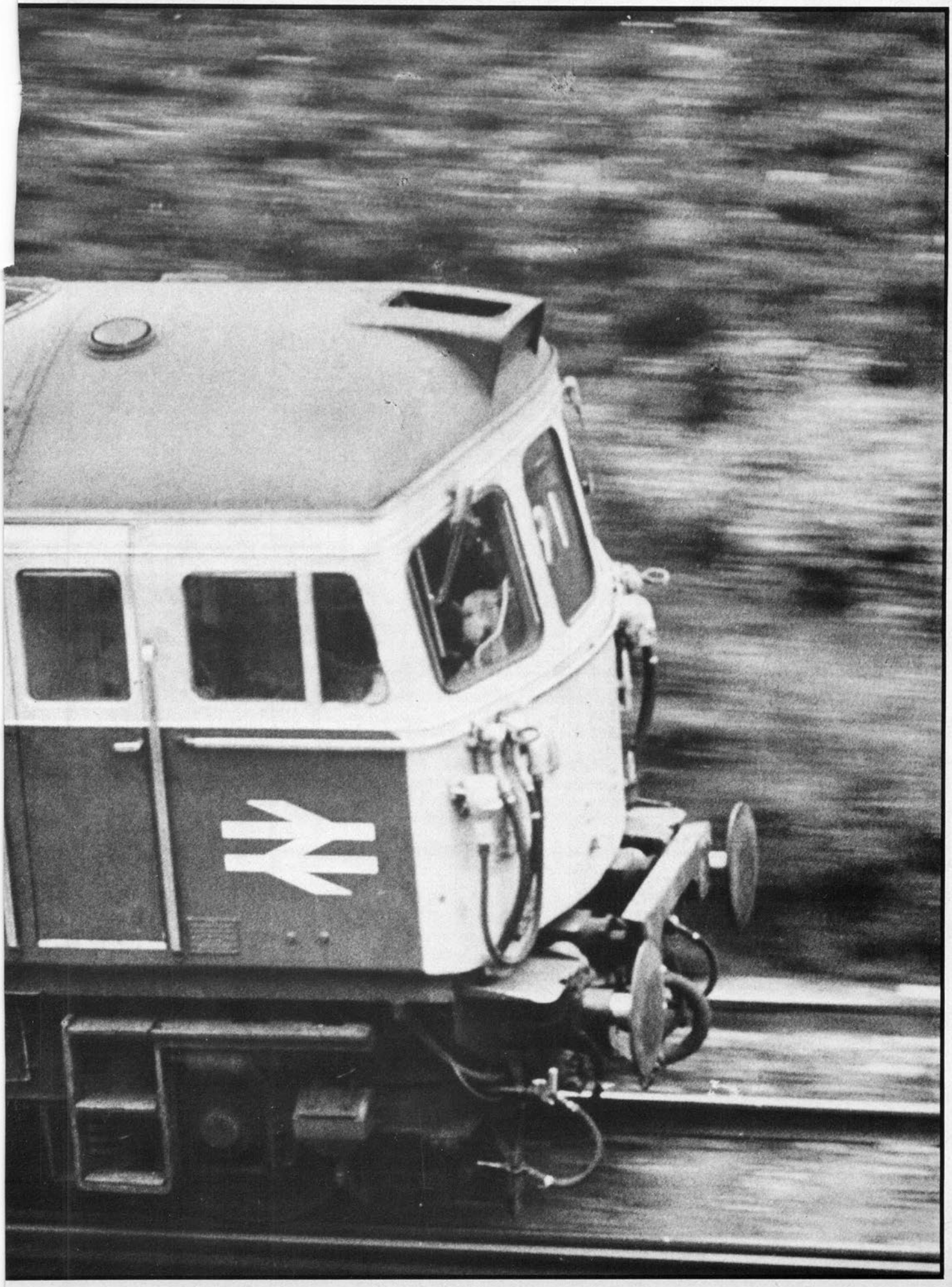
Engine: Paxman 12YJXL
No of cylinders and cycle — 12, four stroke
Max cont rated output — 1,350hp at 1,500rpm
Main generator: GEC WT880A
Traction motors: Four GEC WT440
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 47,000lb at 28.9% adhesion at 3,000A main generator
Cont tractive effort — 24,400lb at 16mph at 1,700A at main generator
Rail hp at cont rating — 1,277hp
Full engine output — available between 7 and 65mph
Braking: Air for loco, vacuum for train, giving a brake force of 84% of loco weight in working order
Speed: 80mph (max permitted service)
Curve: $4\frac{1}{2}$ chains min rad curve without gauge widening, at dead slow speed
Train heating equipment: Spanner
Swirlyflow vertical boiler giving a steaming capacity of 1,500lb/h
Tank capacities: Engine fuel and boiler fuel — 375gal
Boiler water — 600gal

The Versatile Type 3s

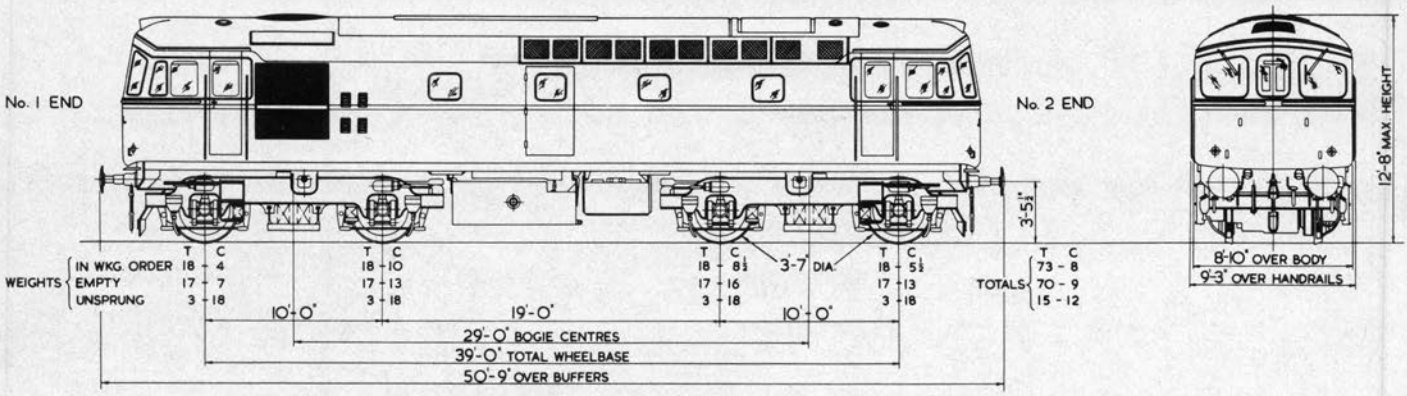
From the day they first took to the rails, both of the diesel-electric Type 3 designs in the BR fleet have established an enviable record for reliability and versatility. No prototypes were constructed; both types going straight into quantity production from the drawing board.

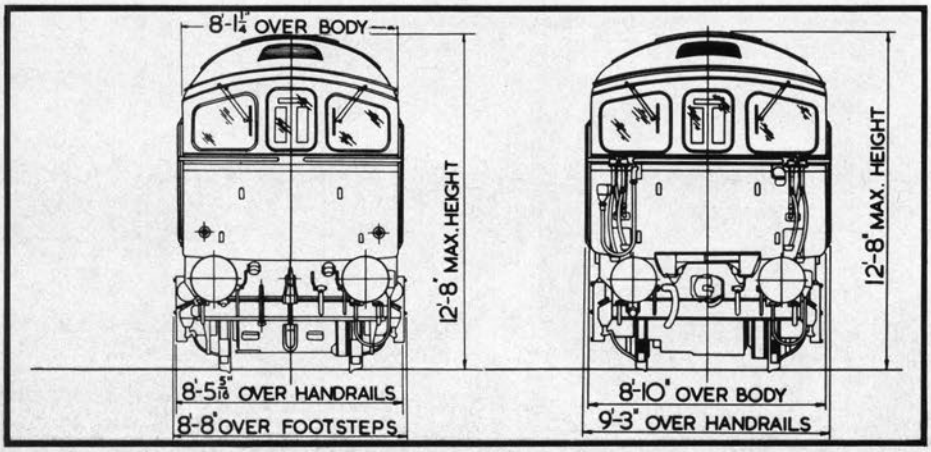


Below: Speeding along between Bournemouth and Branksome with a Waterloo-Weymouth express on 31 August 1975, BRCW Type 3 (now Class 33) Bo-Bo No 33.112 makes a splendid picture. This is one of the 19 examples of the class converted for push and pull working, and reclassified 33/1. *Kevin Lane*



7 Birmingham Railway Carriage & Wagon Co 1,550hp Bo-Bo Type 3





Above: The drawing depicts the Class 33/0 version. Originally Nos D6500-D6585.

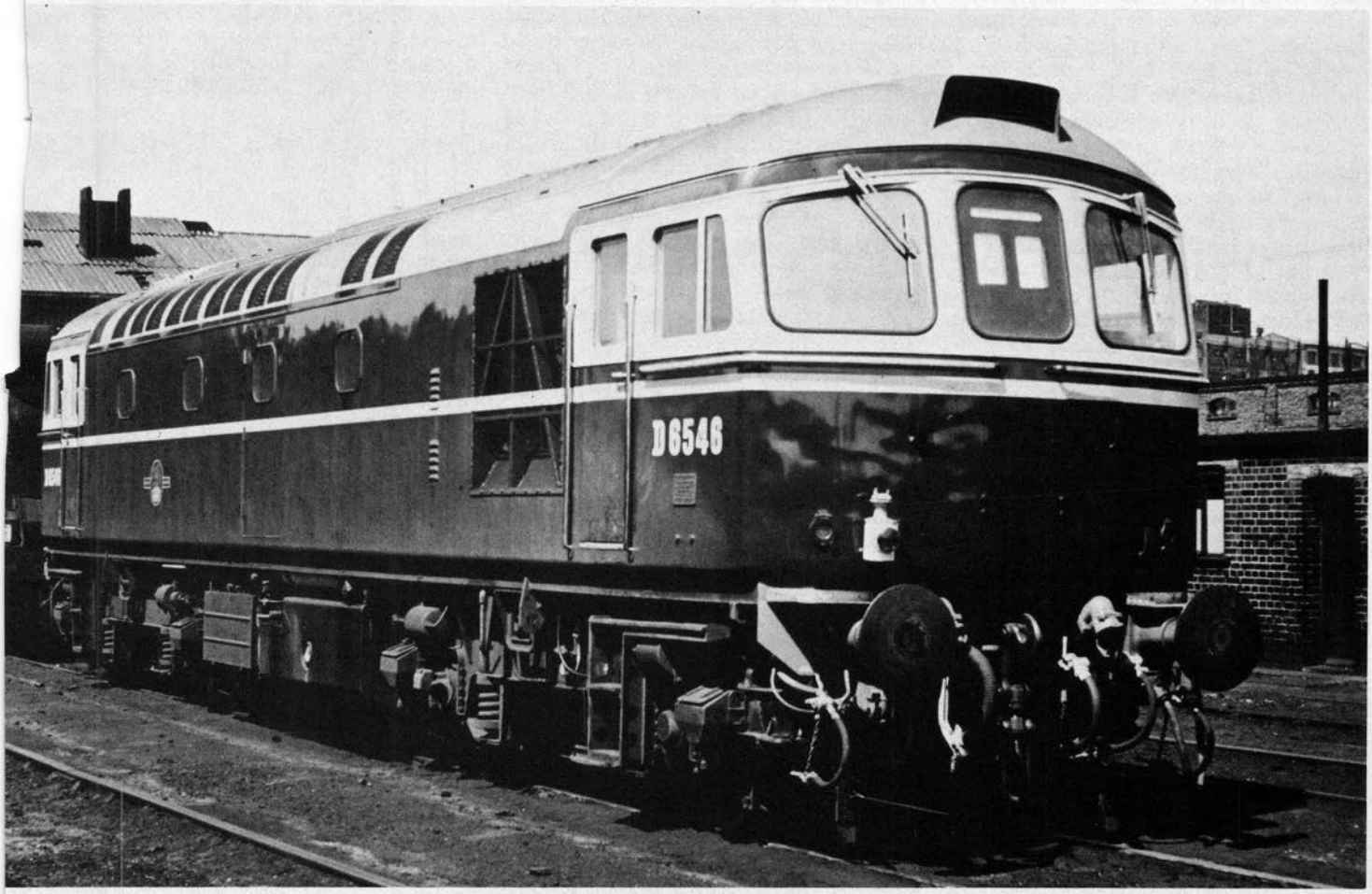
Left: Front ends of the narrower Class 33/2 version (left) specially built for the Hasting line and the 33/1 version (right) as converted for push and pull work. The Class 33/2 were originally Nos D6586-D6597.

Below: With a strong family likeness to the BRCW Co Type 2 design, the SR Type 3 was finished in the same livery style of dark green with off-white lining and cab window surrounds. The roof was a silver/grey shade when brand new; buffer beams were red and bogies and undergear black. The front end design was very neat because no gangway connections were considered necessary, and only the standard SR two-panel headcode was carried; in the centre window. No D6509 is illustrated in original condition. *G. H. Marsh*

Class: BR Type 3, later Class 33
Purpose: Mixed traffic locomotives
Introduced: 1960
Original numbers: D6500-D6597
Total built: 98

Details of Nos D6500-D6597

Engine: Sulzer 8LDA28
No of cylinders and cycle — 8, four stroke
Max cont rated output — 1,550hp at 750rpm
Main generator: Crompton Parkinson CG391B1
Traction motors: Four Crompton Parkinson C171C2
Type of suspension — axle
Type of gear drive — single reduction
Performance: Max tractive effort — 45,000lb at 27.3% adhesion at 2,260A main generator
Cont tractive effort — 26,000lb at 17.5mph at 1,760A at main generator
Rail hp at cont rating — 1,215hp
Full engine output — available between 10 and 80mph
Braking: Straight air and auto air for loco, auto air and air controlled vacuum for train, giving a brake force of 80% of loco weight in working order
Speed: 85mph (max permitted service)
Curve: 4 chains min rad curve without gauge widening



Train heating equipment: Electric Generator — Crompton Parkinson CAG392A1 driven by main engine and giving a cont output of 235kW at 750V
Tank capacities: Engine fuel — 800gal

These sturdy and reliable Bo-Bos have proved to be one of the best buys of the BR dieselisation programme. Today some 22 years later they still serve the SRs needs admirably and together with the Class 73 electro-diesels they tackle all the freight and passenger work originating on the Region, which is not worked by multiple-units. In addition they have regularly been seen on the other Regions, with through workings of various sorts as well as cross-country services; even reaching Scotland in the course of their careers.

When introduced they were primarily intended for freight work, but the SR wisely fitted them with electric train heating which, of course, has since become standard for BR passenger stock. In this and other instances, such as provision for buckeye couplers, the SR was more forward-thinking than its neighbours at this time! Because no train heating boiler had to be carried it was

Above: Fresh from the makers, No D6546 was photographed at Bricklayers Arms shed on 7 May 1961 with a Bulleid light Pacific in the background. These Type 3 Bo-Bos are the most powerful diesel-electrics of this wheel arrangement to operate on BR. *P. H. Wells*

Below: Because the Type 3s were not fitted with train heating boilers, the SR initially found it necessary to borrow some boiler-fitted BR/Sulzer Type 2s to provide carriage heating, until such a time as the rolling stock was converted to eth. Hence we see BRCW Type 3 No D6502 coupled ahead of a BR/Sulzer Type 2 on a Kent Coast boat express. Note the headcode discs carried, despite the roller blind indication. *Derek Cross*

possible to place a larger Sulzer engine within the Type 2 Bo-Bo bodyshell, thereby creating a Type 3 with the minimum of new tooling-up at BRCW. The result was a neater version to look at because it had no gangway doors in the front ends; being otherwise practically identical and finished in the same livery. (The SR General Manager requested that he be allowed to use the green livery of the electric train carriages for these locomotives, but the BTC refused this.)

A total of 98 Class 33s, as they are today known, was considered sufficient for the SR, and sadly none were ever built for other Regions. Of these 98 the last 12 to be delivered from BRCW, were built to the narrower overall width of the Hastings line (see drawing) which gave them a somewhat flat-sided appearance. These 12 are now Classified 33/2. One item unique to all these SR Bo-Bos is that they have always carried the Region's two-digit route indicator roller blinds, between the two outer cab front windows, and have therefore not undergone the various facial operations inflicted upon the majority of the BR diesel fleet in recent years!

When the Southern got the 'go-ahead' to electrify the Waterloo-Bournemouth main line it was partly because they had produced a very cost-effective scheme which re-utilised existing carriages, suitably rebuilt, and retained existing locomotives, converted to suit requirements. In the case of the BRCW Type 3 Bo-Bos, it was necessary to fit push and pull equipment to 19 locomotives in 1966-67, with buckeye couplers and waist level control jumpers, thereby making them compatible with the new electric multiple-units and the 4TC trailer units, as well as with a variety of other SR multiple-unit stock, and the electro-diesels.

A pleasing touch in recent times has been the bestowal of names on a few of the class, although an earlier scheme to name *all* of them seems to have been discarded. The Class 33s seem well set for another decade or more of front-rank service, and the only withdrawals that have taken place to date have been due to accident damage. They are truly excellent machines, and it is a great pity that the adherence to steam for train-heating purposes in the early 1960s excluded their wider use, and hence quantity production, for the other Regions. Long before electrical train heating was at last instituted as a standard BR requirement, the Birmingham Railway Carriage & Wagon Co, who built the 'Cromptons' — as the SR men like to call them — had gone out of business entirely.

Right: The narrow bodied Hastings line locomotives are now classified as Class 33/2. They have a distinctly flat-sided appearance because the bodysides are the same width as the solebars. Two are seen here at Hither Green shed, Nos D6595 and D6592. Yellow warning panels added to the front ends. *P. H. Groom*

Below right: Fresh from overhaul, Type 3 Bo-Bo No D6573 heads a considerable load of oil tankers bound for Fawley, and seen between Millbrook and Redbridge on 5 January 1967. *John H. Bird*

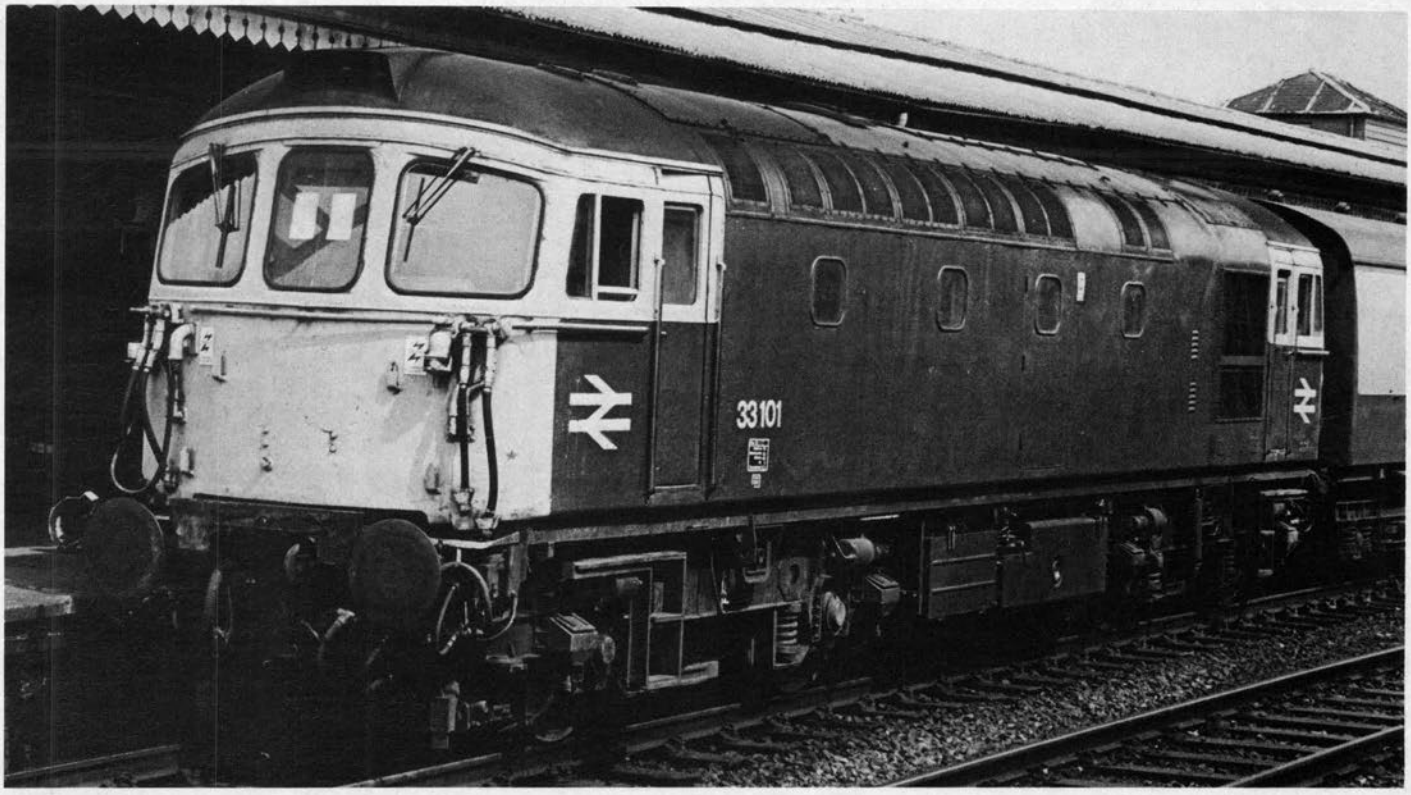
Below: The final 12 locomotives delivered from BRCW were built to a reduced width (see drawing) for use on the Hastings line, which has a restricted loading gauge. Type 3 Bo-Bo No D6582 in ex-works condition is seen leaving Redhill on the 5.40pm to Leigh Halt on 9 May 1962. *G. D. King*

D6595

4A

D6570

6527



Top left: A livery variation is seen here on No D6570, as a result of the decision to paint the ends in yellow overall. Still in green livery, the bodyside lining out has been stopped short at the rear of the cabs at each end, and a carriage-type BR Lion and Wheel emblem is carried. Photographed at Hither Green on 18 February 1970. *P. R. Foster*

Left: As part of the Bournemouth electrification scheme the SR decided to convert 19 of the Type 3s to push and pull operation. The locomotives were fitted with buckeye couplings and the control cables and air pipes were placed high up on the front of the cabs, to make them compatible with the electric multiple units. These locomotives became Class 33/1. No 6527 is seen here before the renumbering, in blue livery with yellow ends and cab window surrounds; photographed at Bournemouth on 3 August 1970. *N. E. Preedy*

Top: The push and pull fitted locomotives can work with certain types of electric multiple-units and with the 4TC trailer units on the Waterloo-Bournemouth line. Here No D6521 is sandwiched between two new 4TC sets (the rear one is No 419), at Bournemouth. The 4TC sets are in their original plain blue livery with cast alloy BR symbols on the cabsides *A. Swain*

Above: Class 33/1 Bo-Bo No 33.101 is seen here at Reading station, working the 7.55am Newcastle-Poole train on 18 August 1981. *C. J. Tuffs*

90
SOV 465S

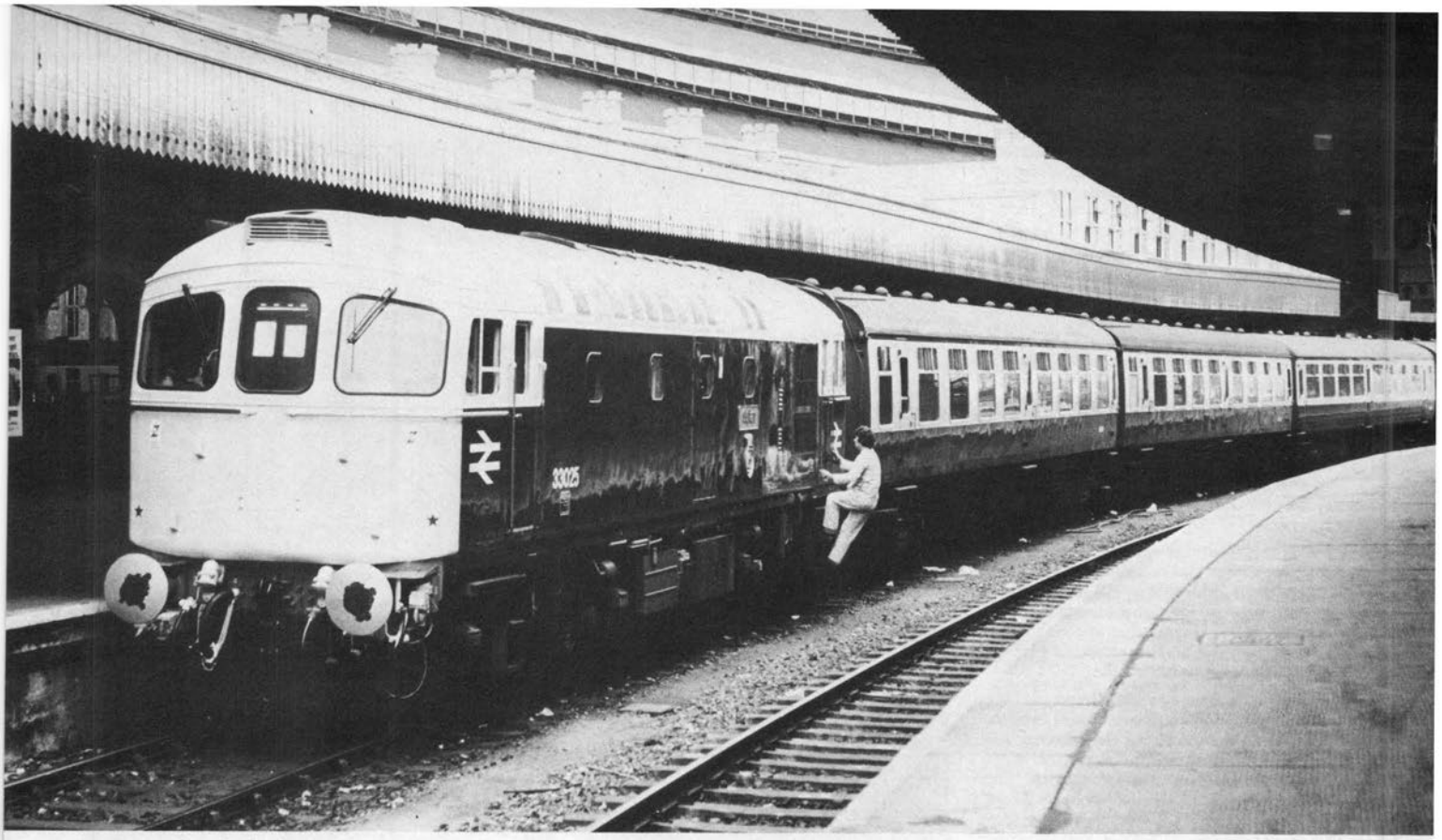
62
5

Left: The Class 33/1 locomotives are regular performers on boat trains to Weymouth. For the last stage of the journey, over the tramway lines to the quay they must carry a warning bell and flashing lamp (required by the Department of Transport). This is a portable unit, plugged in to the front of the locomotive above the coupling, as seen here on No 33.102 heading the 16.00 boat train to Waterloo on 8 July 1978. *Les Bertram*

Below left: Although their official maximum speed is 85mph, the SR Bo-Bos have established an excellent reputation for those express passenger workings that are within their capabilities. Until ousted by the Class 50 'Warships', the Bo-Bos operated the Waterloo-Exeter services, after the WR diesel-hydraulics had proved unreliable. No 33.031 is seen at Exeter St Davids, on the 13.00 from Waterloo, with Class 50 No 50.025 arriving (right) with the 15.50 Plymouth-Paddington, on 15 September 1977. *H. W. Cater*

Right: One of the Hastings-gauge Type 3s, No 6594 is pictured at the head of a Northfleet cement train. Unlike the rest of BR today, the Southern still uses headcodes and as a result these locomotives have undergone little or no alteration to their front end appearance since building. *British Rail SR*

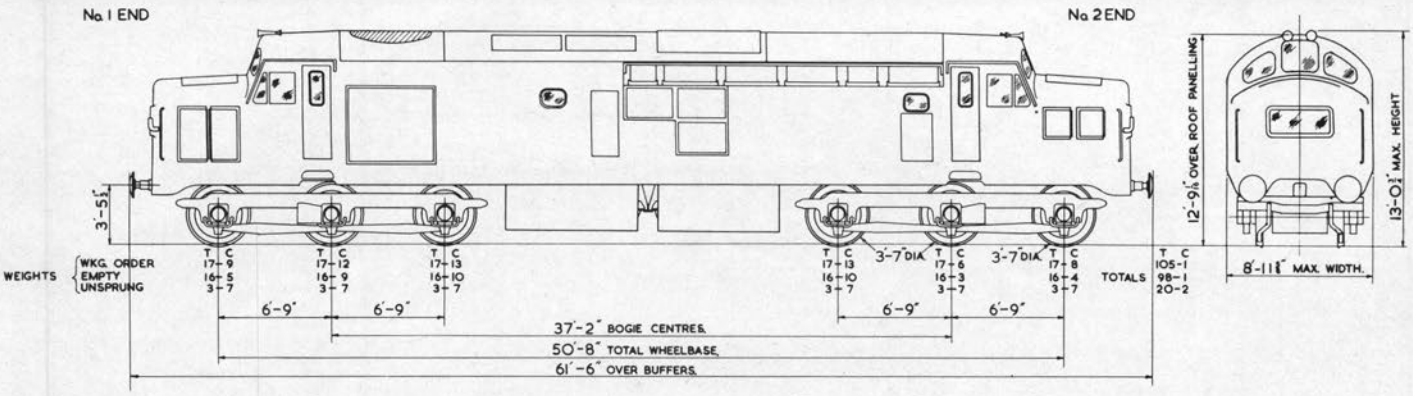
Below: Five examples of the class have had the honour of being named in recent times; thereby raising them to the ranks of the premier motive power on BR in many people's eyes. Both the Class 33s that hauled Lord Mountbatten's funeral train (see photo on page 18) have since been named. No 33.027, seen here, carries the name *Earl Mountbatten of Burma*, and the other locomotive No 33.056 is now *The Burma Star*. In this picture the unique livery of No 33.027 is well portrayed, with off-white cab roofs and red bufferbeams added to the standard blue and yellow scheme. The locomotive was fitted with small snowploughs when it was photographed leaving Southampton on the 14.15 Portsmouth-Bristol train on 2 October 1980. *G. F. Gillham*



Top: Perhaps even more striking is the overall off-white, or silver grey, roof on No 33025 *Sultan*, seen at Bristol Temple Meads station on 9 August 1981, having just arrived with the 11.00 Cardiff-Portsmouth service. This locomotive also has the bufferbeams painted red. It had been named at Portsmouth Harbour station three days previously, and below the nameplates it carries crests supplied by the Royal Navy. *Richard G. Fox*

Above: A recent livery experiment undertaken by Eastleigh is seen on No 33.012 photographed in company with No 33.051 at West Worthing Electric Shed on 1 March 1982. The entire cab is painted yellow, with black surround to the windows and the locomotive number is in black on the yellow front. The roof area is light grey. *Brian Denton*

8 English Electric Co 1,750hp Co-Co Type 3



Class: BR Type 3, later Class 37
Purpose: Mixed traffic locomotives
Introduced: 1960
Original numbers: D6600-D6608, D6700-D6999
Total built: 309

Details of Nos D6600-D6608, D6700-D6999

Engine: English Electric 12CSVT
No of cylinders and cycle — 12, four stroke
Max cont rated output — 1,750hp at 850rpm
Main generator: English Electric EE822/10G
Traction motors: Six English Electric EE538/A
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 55,500lb at 24.1% adhesion at 2,600A main generator
Cont tractive effort — 35,000lb at 13.6mph at 1,800A main generator
Rail hp at cont rating — 1,250hp
Full engine output — available between 10 and 79mph
Braking: Air for loco, vacuum for train (see text) giving a brake force of 82.5% of loco weight in working order
Speed: 90mph (max permitted service)
Curve: 4 chains min rad curve without gauge widening, at dead slow speed
Train heating equipment: Clayton RO 2500/3 boiler giving a steaming capacity of 2,000lb/h*
Tank capacities: Engine fuel — 830gal
Boiler fuel — 120gal*
Boiler water — 800gal*

In appearance the EE Co Type 3 Co-Co was already somewhat dated when it first took to the rails, but in concept and construction it was probably without peer. Retention of the nose ends (complete with flexible gangway connections housed behind twin doors) was already in question on existing locomotives, because the cabs were considerably more draughty with these doors cut into the front ends of the locomotive, and in any case the connections were rarely, if ever used in day-to-day running practice. Unfortunately there existed a difference of opinion about the front end design of locomotives within the BTC at this time, with the Design Panel and some BR engineers (including the next-in-line to the post of CME, J. F. Harrison) wanting to rid the larger locomotives of these nose ends, but with R. C. Bond, then the BR Chief Officer (Mechanical Engineering), and indeed EE Co's own design draughtsmen stating that they liked the nose ends; having already produced the prototype 'Deltic', the Type 4 1Co-Co1s and the 'Baby Deltics' with this feature.

Setting aside questions of aesthetics, it is probable that the EE Co was able to quote an attractive price *per* locomotive because many of the components of the superstructure — including the cab doors, windows, nose ends, gangways and various fitments were in common with the Type 4 D200 class (today's Class 40) and therefore no fresh tooling-up was required. What first appeared from the production line was by no means an ugly machine (and it was to be improved once the gangways were dispensed with, as the illustrations show), but the fact remains that it *could* have been considerably better in terms of appearance! It was the last nose-end diesel design to be built for BR, and probably the best.

If one looks at the pioneer 1,600hp, 16-cylinder LMSR Co-Cos of 1947/48, Nos 10000/1, with EE Co engines, and then at these 1,750hp 12-cylinder Type 3s of 13 years later, it becomes evident that very considerable progress with diesel engine design had been made, in particular by EE Co. But one might also question why there was not an initial pilot scheme version of

Above: The drawing depicts the later production series, with four panel route indicator in the nose ends, no gangway connections, and air horns placed in roof above centre cab window. The weight shown is when fitted with a steam-heating boiler.

Below: The EE Co Type 3 Co-Co design was unfortunately first produced at a time when BR had adopted the four panel route indicator, but before they had decided to abandon the use of gangway connections. Hence the nose ends had an untidy arrangement (actually devised by EE Co for their Type 3 1Co-Co1 D200 class), with two large boxes each carrying two digits; one each side of the gangway doors. The air horns were located in the two circular apertures above the route indicator boxes. The general appearance of the class was very similar to the D200s except that there were more air intake grilles in the bodysides. Livery when new was dark green without lining; mid-grey roof above engine compartment, black bogies and undergear, and red bufferbeam. The small yellow warning panel was soon added, as seen here on No D6723; working a GE line express. *EE Co*

*Denotes when fitted (see text).

Above: Coupled to a Diesel Brake Tender, Type 3 Co-Co No D6769 awaits its next turn of duty at Thornaby. Part of a second brake tender is in the right hand background, showing the Gresley bogies many tenders were fitted with. *Brian V. Alderwick*

Right: In brand new condition EE Co Type 3 Co-Co No D6831 shows the much neater nose end made possible when the gangway connection was not fitted; commencing with No D6819. The air horns were repositioned from the top of the nose ends to the top of the cab roof. No D6831 is seen at Cardiff (Radyr) motive power depot. *John White*

Nos 10000/1 — the missing Type 3 category — because when it did finally appear, in the form of No D6700 in December 1960, it was the most useful diesel-electric locomotive to emerge to that date. The operating department fell in love with it immediately. It had sufficient power to take on many Type 4 duties, without being so cumbersome, and it left the Type 2's standing in its versatility. The finest 'maid-of-all-work' on BR today is this Co-Co, which is virtually the same as Nos 10000/1 in overall dimensions, but which weighs approximately 30 tons less, and develops 150hp more with four cylinders less in the engine.

Whilst the Type 3 Co-Co was in the throes of design and construction, the EE Co were also producing the 22 Type 5 'Deltic' 3,300hp Co-Cos for BR. Both types were in fact at first destined for the same Region, the ER, and they had a common design of bogie and traction motor. The less sophisticated Type 3 was the first to emerge and within a very short space of time the bogies unfortunately revealed problems with fracturing, (as a result delaying the 'Deltic' production; as described in book three of this series). These bogies had frames of fabricated design, and eventually this method of manufacture was replaced by cast steel (for later locos of the Type 3 class, and for all the 'Deltics), although satisfactory modifications were made to the fabricated version which is still giving good service under numerous examples of the Class 37s — as they are now known — today.

The provision of a train heating boiler was a requirement forced upon EE Co by the BTC, but nowadays many locomotives are running with this archaic item either removed entirely, or at least isolated. On some locomotives the redundant boiler water tank, of 800gal capacity, has been adapted as a second engine fuel tank; raising the engine fuel capacity to a total of 1,750gal. These changes, and modifications to the braking systems (dual brakes) on some locomotives have meant that the weight of individual locomotives varies, with the heaviest being those with the boiler fitted and dual braked, 105ton 13cwt and the lightest those with the boiler removed, at 100ton 12cwt.

The EE Co was able to build these Type 3 Co-Cos at two locomotive works consecutively and this allowed rapid deliveries; in particular to the WR where the class quickly ousted the diesel-hydraulics in South Wales. The locomotives were built as follows:

Nos D6700-D6768	Vulcan Foundry
Nos D6769-D6795	Robert Stephenson, Hawthorn
Nos D6796-D6818	Vulcan Foundry
Nos D6819-D6828	Robert Stephenson, Hawthorn
Nos D6829-D6858	Vulcan Foundry
Nos D6859-D6868	Robert Stephenson, Hawthorn
Nos D6869-D6878	Vulcan Foundry
Nos D6879-D6898	Robert Stephenson, Hawthorn
Nos D6899-D6999	Vulcan Foundry
Nos D6600-D6608	Vulcan Foundry

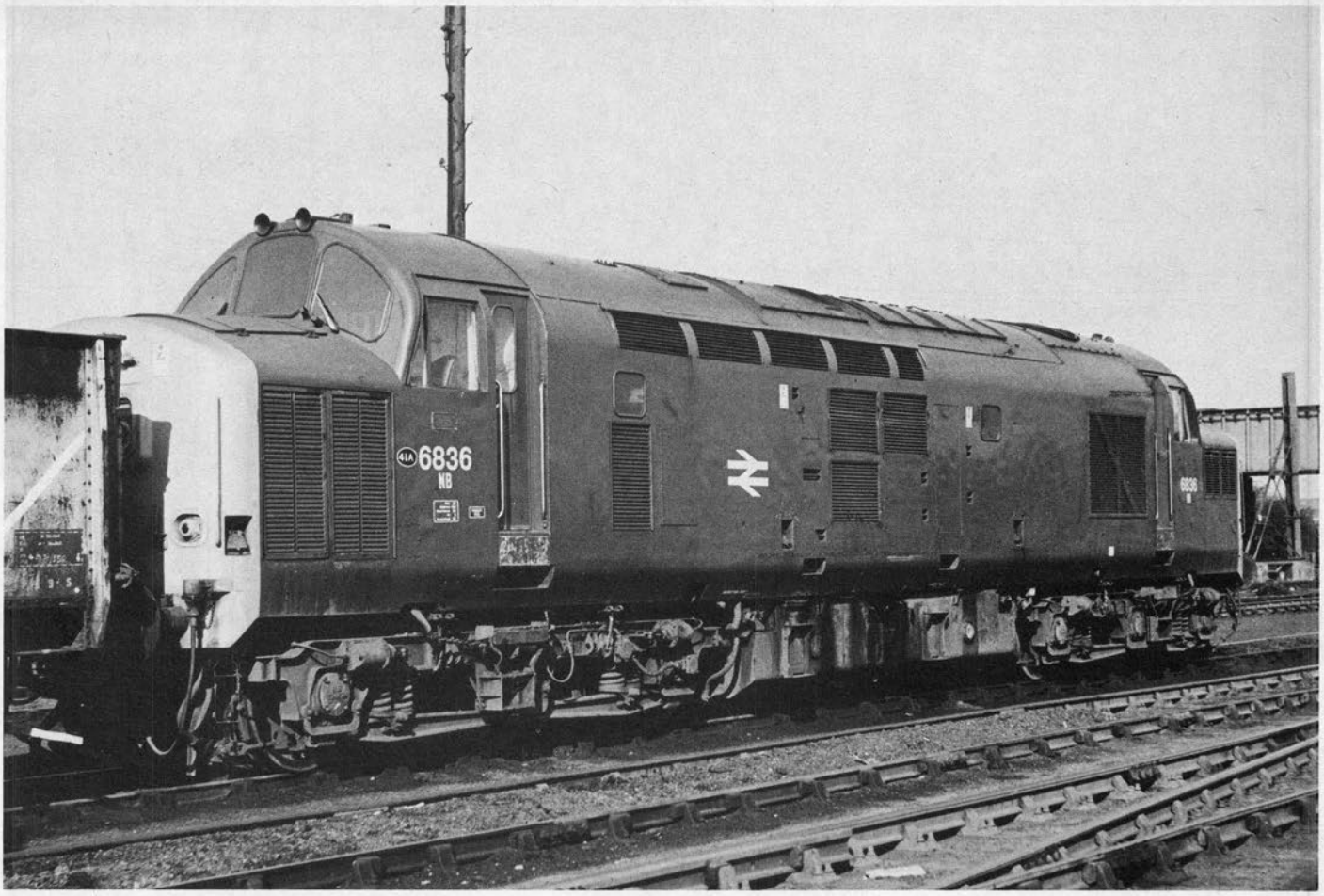
Some mystery surrounds an ER scheme to name some of the class in 1963/5; the examples being used for passenger work on the GE section. The author has a British Railways Board document dated February 1965 which shows No D6707 with the name *The East Anglian Regiment*; but it is not certain if these nameplates were ever actually displayed. Earlier, in the spring of 1963, plates were fixed to the sides of three locomotives but never officially unveiled; being covered over until removal! These were Nos D6703 *First East Anglian Regiment*, D6704 *Second East Anglian Regiment* and D6707 *Third East Anglian Regiment*. Happily, some of the class on the ScR and WR have recently received names, in the stylish standard polished alloy finish, with red background, and it is to be hoped that the ER will now follow suit, but with more imagination!

Above: Without the 'D' prefix to the number, No 6600 was photographed at Gloucester Central on 2 February 1969. It was the arrival of the EE Co Type 3s on the WR that heralded the end of the diesel-hydraulic traction era. *N. E. Preedy*

Below: EE Co Type 3 Co-Co No D6801, still in green livery but with overall yellow nose ends, is seen leaving Peterborough at the head of a mixed freight bound for Healey Mills on 5 August 1968. *Leslie Riley*

One interesting phase in the career of the EE Co Type 3s took place on the WR, when in the summer of 1965 trials were run with pairs of the locomotives in multiple between Paddington and Bristol, and the West of England. Offering 3,500hp the selected locomotives were temporarily allowed to exceed their normal 90mph maximum service speed, in order to gain experience with high speed passenger workings; speeds of 102mph and 104mph being officially recorded. Another interesting official trial was with No D6700, which the Derby Research Centre fitted with push and pull controls. The locomotive was sent to Scotland in February 1968 for push and pull trials at speeds of up to 90mph between Edinburgh and Glasgow; being the forerunner of today's regular service in this manner, although the Type 3s were not chosen for conversion, the BRCW Co Type 2s being used instead until the conversion of today's Class 47/7 Co-Cos.

Equally at home on massive freights or express passenger work, the Class 37s will remain in the front rank of BR diesel power for the foreseeable future and no significant withdrawals are scheduled, although a few have sustained accident damage which has since led to their withdrawal.


41A 6836
NB

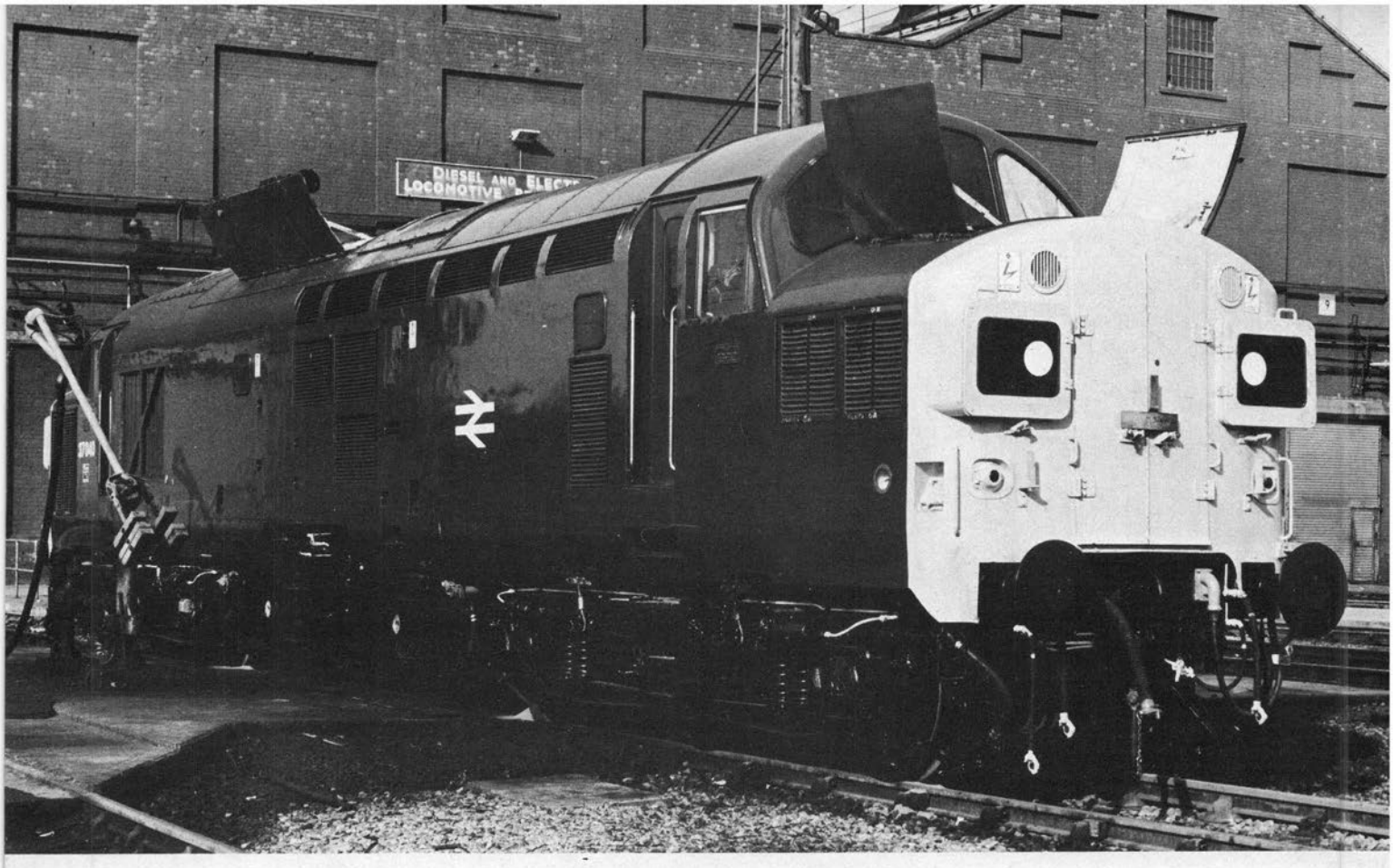
1Z75
6889

Top left: In blue livery, with yellow ends, No 6836 displays a 41A Tinsley shedcode beside the number and the letters NB — no boiler — below. Although some of the class are still fitted with steam train heating boilers, many have had them isolated, if not actually removed. No 6836 was photographed at Wath on 2 May 1971. *David Wharton*

Left: Some of the Welsh-based WR allocation of EE Co Type 3s have been fitted with a centre headlight, as seen on No 6889, for working on the Central and West Wales lines which have unprotected level crossings. No 6889, photographed on an enthusiast's railtour at Llanelli on 31 October 1970, also features an early version of the BR blue livery, with symbols and numerals grouped together on the cab sides. Small snowploughs fitted. *Adrian Bodlander*

Top: Also fitted with the small snowploughs, EE Co Type 3 (now Class 37) No 37.175 heads an up freight at Bishton Crossing, on the relief line, between Newport and Severn Tunnel; 24 April 1975. *Philip D. Hawkins*

Above: Class 37 Co-Co No 37.074 starts the long climb up the 1 in 40 gradient at South Pelaw, Chester-le-Street with a load including two 14-axle 'torpedoe' wagons of molten steel travelling from Hartlepool steelworks to Consett steelworks for further processing, on 30 June 1977. Four panel route indicator still fitted with roller blinds, but no longer displaying a headcode. *Peter J. Robinson*


DIESEL AND

Top left: The two marker lights now fitted into the former route indicator boxes give a somewhat cross-eyed look to the front end of Class 37 Co-Co No 37.040. The locomotive is seen at Crewe receiving the finishing touches after an overhaul, on 25 February 1979. Note the access doors on top of the nose end and in the roof, in the open position. Gangway doors sealed up. *Barry J. Nicolle*

Left: A permanent arrangement of two marker lights has now been decided upon for the class, with the route indicator boxes plated over with steel sheet. Other changes being made during overhaul include removal of the skirting around the bufferbeams and replacing the round buffers with oval ones; the outer grille to the large radiator louvres on the bodyside is also removed. No 37.090, in ex-works condition shunts its test train at Doncaster on 23 April 1981. *Colin J. Marsden*

Top: The modified front end around the bufferbeam area, and the new oval buffers fitted are well illustrated here; also the two marker lights installed. No 37.180 is seen on the 11.15 Swansea-Milford Haven train leaving Carmarthen immediately after a naming ceremony on 28 May 1981, when it was named *Sir Dyfed — County of Dyfed*. The new nameplates are in polished alloy with a red background. *British Rail WR*

Above: Class 37s have now been drafted to the West Highland lines, and some have been named. Before naming, No 37.027 (now *Loch Eil*) was experimentally painted in a livery of blue with yellow nose ends, cabsides and cab doors, and black window areas. Although obviously based upon the new official livery for the Class 56, 50 and 47, it was a Regional initiative and incorrect in application, and has since been removed. No 37.027 shows the front end modifications and oval buffers, and the outer grille removed from the radiator louvres (behind nearest cab door.) Photographed at St Rollox on 27 June 1981. No 37.112 was similarly liveried at this time, but with blue cabside doors retained. *Mick Howarth*

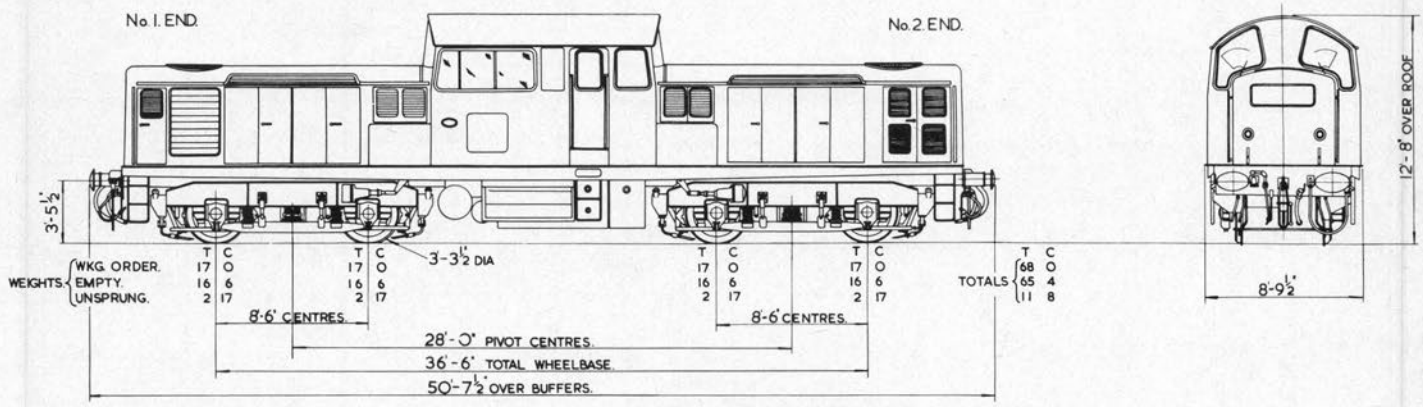
The Standard Design that Failed

The Clayton Equipment Co Type 1 Bo-Bo was produced as the standard successor to the pilot scheme designs. In particular it was designed to offer good all-round visibility for the enginemen; a feature not possible with the 'hood' units. Plagued by engine troubles, the 'Claytons' as they became known were all withdrawn by BR after only a decade of spasmodic service.

Below: The first of the class, No D8500, was sent to Marylebone for official inspection, when new, and is seen here in the goods yard. Livery was dark green with grey/green cab above waist level, and on the window surrounds with grey cab roof, red bufferbeams, small yellow warning panel and black bogies and undergear. *British Rail*

0Z00

9 Clayton Equipment Co 900hp Bo-Bo Type 1



Class: BR Type 1, later Class 17
Purpose: Freight locomotives
Introduced: 1962
Original numbers: D8500-D8616
Total built: 117

Details of Nos D8500-D8585 (see text relating to later locos)

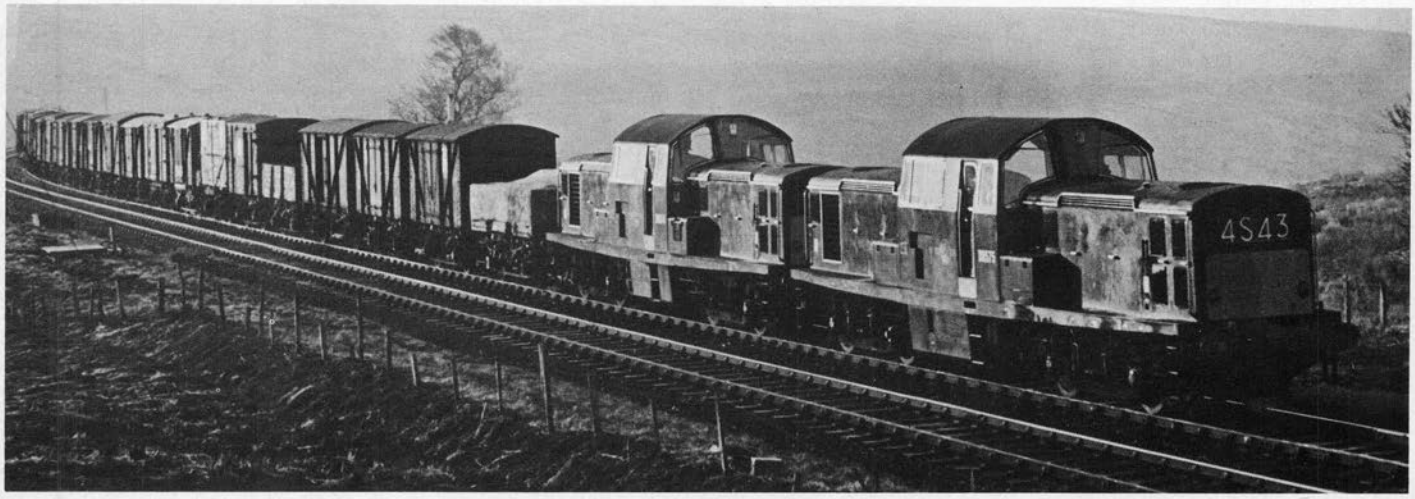
Engines: Two Paxman 6ZHXL
No of cylinders and cycle — 6, four stroke
Max cont rated output — 450hp at 1,500rpm each
Main generators: Two General Electric Co WT800
Traction motors: Four General Electric Co WT421
Type of suspension — nose
Type of gear drive — single reduction
Performance: Max tractive effort — 40,000lb at 26.2% adhesion at 1,400A each main generator
Cont tractive effort — 18,000lb at 12.8mph at 700A each main generator
Rail hp at cont rating — 602hp
Full engine output — available between 3 and 60mph
Braking: Air for loco, vacuum for train, giving a brake force of 86.7% of loco weight in working order
Speed: 60mph (max permitted service)
Curve: 3½ chains rad curve without gauge widening, at dead slow speed
Train heating equipment: Not fitted
Tank capacities: Engine fuel — 500gal

Anyone who has ridden on the footplate of a large and powerful steam locomotive will have observed how restricted the forward vision from the cab is; due to the width and length of the large boiler carried. By knowledge of the road and by teamwork the engine crew could however ensure that signals were safely sighted, but one can vividly recall some instances where heads had to lean far out of the cabside windows, and where drifting exhaust further troubled the driver. It seems strange in retrospect that these conditions were to some extent repeated on the pilot scheme Type 1 diesel-electrics — where the large hood, or bonnet, housing the engine took much the same dimensional form as a steam boiler and restricted the forward vision when the locomotive was working 'bonnet-first' — particularly as it was envisaged that single-manning could be used in daylight hours.

The Chief Signal Engineer was understandably not enthusiastic about this, and a directive was issued that wherever possible these locomotives should be worked with the driving cab end leading — not possible during shunting operations of course! An alternative locomotive layout, with the cab placed centrally and the engine bonnets reduced in height, seemed to present a practical and attractive solution. This could

Above: The drawing depicts one of the first, Clayton-built batch; Class 17/1.

Below: No D8517 amidst a group of 'Claytons' at Motherwell depot on 29 March 1964.
R. A. Panting



Top: The 'Claytons' as they became known, unfortunately suffered from engine problems; so severe that many were put into store quite quickly. Two of the class, Nos D8514 (leading) and D8505 are seen double-heading a Glasgow-Ayr relief train near Kilwinning (Dalgarven) on 21 July 1964. *Derek Cross*

Above: The 'Claytons' seem to have spent a good deal of their time running in multiple-unit. When 'paired' however, they had no real advantage over the EE Co Type 1s (provided the EE Co locos were coupled with the cabs at the outer ends). Nos D8574 and D8575 work together on the climb to Whitmore summit with a northbound freight on 13 March 1965. *Paul Riley*

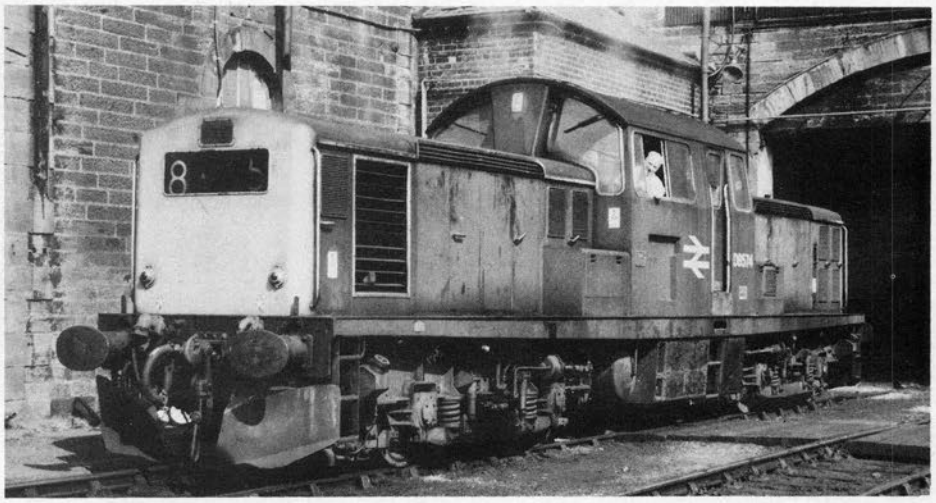
be realised by using *two* Paxman flat engines (originally designed for railcar use) per locomotive, to provide sufficient power. Accordingly a new standard Type 1 Bo-Bo design was drawn-up to replace the 'hood' units for new construction. Externally, the appearance was the subject of Design Panel attention, with the consultants Allen Barnes, Bowden Ltd producing quite a handsome-looking machine. The cab certainly gave excellent all-round visibility, and there was plenty of space for the enginemen; in fact it occupied nearly a third of the length of the superstructure! This centre cab was ideal for shunting work, which the locomotives could perform quite satisfactorily whilst running with one engine switched off, thus offering some economy.

Two setbacks soon caused BR to query the wisdom of having ordered so many of the class without first of all making extensive trials of a prototype, and what had seemed such a promising design came under a cloud of suspicion and discontent. The first was the Paxman engine, two per locomotive, which quickly revealed faults in service so severe that some new locomotives were put into store pending investigations. There were camshaft failures and fractured crankcases, leaking oil into the main generators, and these and other problems at one stage reduced the locomotive's availability to around 50% (compared to around 90% for the EE Co Type 1) a figure most disturbing to all concerned. The second setback was that the type of traffic for which the class was intended and ideally suited — light to medium loaded freight work, with yard shunting — was disappearing from the BR scene because of Dr Beeching's infamous 'axe' which was particularly severe in the cuts it made in the ScR where the 'Claytons' were allocated. As a result they were often used for heavier freight work (and some summertime passenger work) coupled in pairs. This use of course, offered no advantage over the more powerful EE Co unit when these latter locos were worked in this fashion, with the cabs at the outer ends.

The bulk of the first batch (Nos D8500-D8585) of 'Claytons', as they were popularly nicknamed, was built by the Clayton Equipment Co between September 1962 and February 1964. The final two, Nos D8586/7 appeared later, in December 1964 and February 1965 ands were modified to run with twin Rolls-Royce engines of 8-cylinder 450hp capacity; this necessitated a slight modification to the bonnet housing (see photo). This was an experiment which does not appear to have produced any significant improvement. The second batch, Nos D8588-D8616 was constructed by Beyer Peacock and differed from Nos D8500-D8587 in having the Paxman engines allied to Crompton Parkinson electrical equipment; the basic dimensions and performance characteristics being very little changed. These were delivered between March 1964 and April 1965. Performance was still so bad that some three years later withdrawals commenced — only to be followed by reinstatement of some as traffic demands increased — and then withdrawal in earnest began again in the autumn of 1971; all going after less than 10 years in service! Meanwhile BR had placed a further order for 100 EE Co Type 1 Bo-Bos in 1965, as described on page 26, despite their visibility problems. The Clayton design had proved to be a failure, and a costly one for BR; the rationalisation of the National Traction Plan put paid to any ideas of persisting with the design, and only one example remains today, No D8568, preserved by the Diesel Traction Group on the NYMR. The 'Claytons' were to have been Class 17 in the BR renumbering scheme, but none ever carried their new numbers, although some did end their days in blue livery.

Top: The Paxman flat engines used in the Clayton Type 1 Bo-Bos were the main source of trouble; suffering from fractured crankcases amongst other things. Of course, putting two engines into each locomotive, in some ways doubled the problems of availability! To judge from the filthy exhausts of Nos D8570 and D8578 in this picture, their Paxmans were far from healthy as they worked hard, on a northbound goods past Steele Road on the Waverley route; 29 June 1966. *Derek Cross*

Above: The engine troubles reached a critical stage where newly-built locomotives were not accepted into traffic by BR; going instead into store pending investigations. Here we see a collection of new Type 1s standing idle in St Andrews goods yard, Derby in March 1963. The locomotive on the extreme left of the picture is still in undercoat. *Ian Allan Library*



Top: Two of the Clayton Type 1 Bo-Bos were fitted with an alternative type of engine. They were Nos D8586/7 which had twin Rolls Royce 450hp 8-cylinder engines. No D8586 is illustrated, showing the slightly raised housing on the centre of the bonnets that was necessary to accommodate this engine. Full yellow ends now added to the two-tone green livery. Note that all 117 of these locomotives had a recess in the cabsides to take a tablet catcher (rarely fitted, it seems). Photographed at Millerhill yard Edinburgh on 10 August 1969. *N. E. Preedy*

Above: Under the TOPS renumbering scheme the 'Claytons' became Class 17, but none lasted long enough in traffic to be renumbered, although some did carry blue livery, as seen on No D8574 standing at Motherwell on 6 September 1971. *N. E. Preedy*

Below: The locomotive rationalisation featured in the BRB's National Traction Plan put paid to the troublesome 'Claytons' all of which were withdrawn by the end of 1971, when some were placed in store. A long line stand dismally in the snow at St Rollox works Glasgow, on 13 February 1973. Vandalism had soon ensured that they would never run again! *J. M. Kite*

Top: In the same month of February 1973 only one 'Clayton' remained operational on BR. This was No 8598, assigned to the British Rail Research Division and used to haul a variety of special test trains. *British Rail*

Above: At this time a second 'Clayton' still existed at Derby, renumbered 18521, and this had been converted into a mobile power station. No 18521 is the nearest in this picture, with the Research Division's No 8598 behind, photographed at St Rollox works Glasgow on 14 October 1978. Both have now been scrapped. *John Chalcraft*

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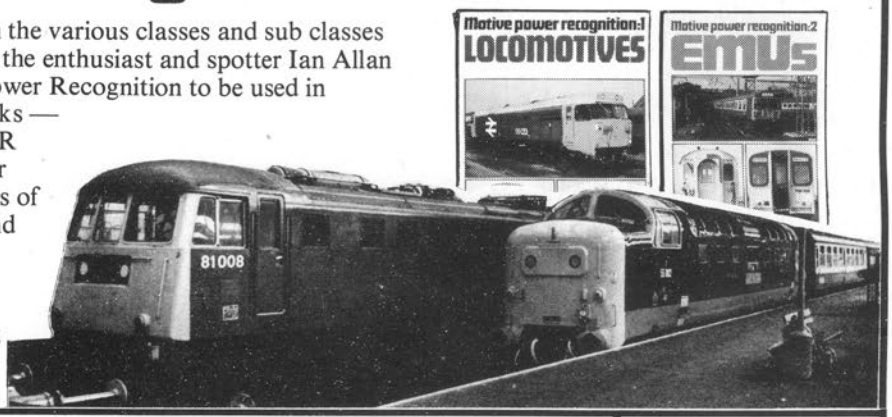

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